TECHNICAL GUIDANCE COMMITTEE
FOR INDIVIDUAL AND SUBSURFACE SEWAGE DISPOSAL

December 11, 2002 MEETING MINUTES

PRESENT: Joe Canning, P.E., B&A Engineers
Rex Browning, Licensed Installer
Barry Burnell, REHS - DEQ
Dan Kriz, Environmental Health Director, SCDHD
Ken Babin, Supervisory REHS, PHD
Mike Reno, REHS – CDHD

GUESTS: John Robinson, Infiltrator Systems Inc.
Kelly McConnell, Infiltrator Systems Inc./Givens Pursley
Mark Mason, P.E., DEQ-Wastewater Program

The meeting was called to order at 8:30 am December 11, 2002. A sign in sheet was passed to the Committee and guests to sign in. The guests were asked to sign in and indicate if they were interested in presenting to the committee. No one indicated an interest to provide testimony.

December 4, 2001 TGC minutes - review, amend, and accept.

The Committee reviewed the minutes. Joe Canning moved that the committee accept the minutes. Ken Babin seconded the motion and the committee voted in favor of accepting the 12/04/2001 TGC minutes as final. **See Appendix A**.

TGC Preliminary Approval Reviews for Final Approval

A. Drip Distribution System

The Committee discussed the drip distribution system for inclusion into the TGM. The Committee reviewed the comments submitted by the public. Suggested changes were discussed and made to several sections. A summary of the changes made to the drip distribution system section are listed below.

Conditions of Approval:
Condition of Approval #1 was amended to include a citation for the large soil absorption systems. This condition was amended to indicate that if pretreament systems are used, then the soil separation distances indicated by the pretreament method would apply to the location of the drip distribution piping. Condition of Approval #2 was deleted, as this condition was a restatement of the rules.

Design:
Element #4 was modified to allow for use of smaller mesh filters.
Element #10 was revised to delete the use of trademark nomenclature.

Construction:
Element #10 was modified to include a requirement that the drainfield area is to be suitably re-vegetated.

Figures:
The TGC requested that Figure 1 include the option to route the field flush line straight to the septic tank rather than through the filter, valve, and meter box. The TGC requested an additional figure of the filter, valve, and meter box assembly.

Ken Babin moved to accept for final approval the Drip Distribution System section as amended during discussion. Joe Canning seconded the motion and the committee voted in favor of **final approval**. **See Appendix B** TGM page 33-1 to 33-5.

<u>B. Graywater System</u>
The Committee discussed the graywater system for inclusion into the TGM. The Committee reviewed the comments submitted by the public. Suggested changes were discussed and made to several sections. A summary of the changes made to the graywater system section are listed below.

Description:
The description was amended to include discharges from water softeners as part of the graywater waste stream. Discussion was focused on recharge rates and frequencies.

Conditions of Approval:
The Committee discussed the conditions of approval and made several changes. Condition #3 was modified from requiring the graywater tank to meet the criteria of a septic tank to being a tank that is watertight and non-corrosive. Condition #6 was deleted. This was a limitation for graywater systems to be applied only to individual dwellings.

Other Requirements:
The Committee discussed the valves and plumbing of a graywater system. The Committee added a sentence to Other Requirement #2. "Ball valves are recommended to be used in the system." Other Requirement #3 surge tanks and system venting was reviewed and changes were made to this subsection to establish acceptable tank and venting designs. As a result the figures were modified to resolve venting design issues. If the surge tank is within the structure, then the venting must meet the requirements of the Uniform Plumbing Code. Outside surge tanks shall be vented with a 180° turn and are screened to prevent access to the graywater by insects. The label requirement was moved from the side to the access lid.
Other Requirement #4 filters. This section was revised to read: "Filters with a minimum flow capacity of 25 gallons per minute are required."
Other Requirement #6 Irrigation Systems. Delete the experimental descriptor for drip distribution systems.

Figures:
The Committee modified the figures by eliminating the depiction of the ground surface, and to move the label from the side of the surge tank to the tank access lid.
The Committee requested that DEQ develop an informational graywater system brochure.

Joe Canning moved to accept for final approval the Graywater System section as amended during discussion. Rex Browning seconded the motion and the committee voted in favor of **final approval**. **See Appendix C** TGM page 42-1 to 42-6.

DEQ Update on Proposed Rules

The Onsite Coordinator informed the Committee that the DEQ Board had adopted the proposed rules and were pending legislative confirmation. The Committee was informed that the rules did not receive favorable public comments on the wastewater flow section from the districts, counties and from the Building Contractors Association. The Building Contractors Association was also opposed to the factors that were negotiated to determine the conditions under which reasonable access to central wastewater treatment facilities would be reviewed. The TGC role in rule making has been severely hampered as a result of the negotiation process and the additional review steps DEQ is directed to conduct.

Committee members strongly voiced their opinions on wasting Committee time in developing rule packets, proposed rules, printing and distributing proposed rules to have Health District Staff oppose the proposed rules during negotiations and public comment periods rather than voicing these concerns with the Committee. The Committee recognizes the public and political process that rules must go through, but feels that the Committee's time spent developing the rules needs to be fairly evaluated. The Committee questioned the value of preparing proposed rules. Problems noted by the Committee in the proposed rules are changes in the Committee's recommendation for estimating wastewater flow from single family dwellings, and the language developed for the homeowner/installer exemption.

The Committee discussed the changes in the pending rule and the deletions of the flow section as an attempt to resolve the problems with the rule. The release of sanitary restrictions at the time plats are signed does not obligate the districts to issue an onsite permit. Site conditions may change, roads and easements may be issued, rules may change, or site soils may be modified as a few examples of changes that may result in a site no longer meeting the criteria.

(Note the rules were rejected back to DEQ by the legislature. See HCR 16 at the following webpage: http://www3.state.id.us/oasis/HCR016.html)

TGC Updates

The Committee reviewed the list of TGM updates. The TGC discussed the requirement for a structural engineer to stamp/certify septic tank designs that specify use of structural engineering fibers. Information was provided as an issue from the field for a request to reconsider this requirement. Civil engineering and structural engineering project types were reviewed. Some civil engineers have experience with structural reinforcing fibers if they have worked on catch basins, vaults, roadways, pre-cast structures, and airports for example. Some liability is retained by the civil engineers for these designs.

Ken moved, based on Joe's recommendation, that the TGM be modified so that a professional engineer with experience in the use of structural reinforcement fibers are allowed to stamp septic tank plans and specifications. Mike seconded the motion and the Committee voted in favor of the motion.

TGM page 23, section 2.b. Concrete septic tank reinforcement shall read:

2. Concrete Tanks

  b. Reinforcing steel shall be ASTM A-615 Grade 60, fy = 60,000 psi, details on placement shall be in accordance with ACI 315 and ACI 318 or equivalent as certified by a licensed professional engineer <u>experienced in the use of structural reinforcement fibers</u>.

Product Reviews

1. Eljen Xpandable Chamber.

The committee was given a packet of information from the Eljen Company requesting approval for use in Idaho of the Xpandable Chamber. The committee expressed concern over the anti-siltation fabric collapsing during backfilling and the void area being filled with dirt. Concern was also expressed about the product collapsing under backfill conditions along the sides. The Committee asked if there was provided any track record and testing information. The committee noted that the information provided about the product did not indicate if in any other state had granted approval of the product.

Dan Kriz moved that the committee table the product review until additional information is provided and requested information be provide on the following topics:

1. Soil support for anti-siltation fabric. How much soil can the fabric support;
2. Provide a list of other state approvals; include number of years approved and number of systems installed; provide state agency contact; and provide basis for the state approval;
3. Describe how unit sidewalls will not collapse should the drainfield and surrounding soil become saturated and drained;
4. Describe loading limits of the product. Under what forces is the product crushed;
5. Describe how the product is consistent with other proprietary products;
6. Provide any independent third party testing data;
7. Provide any field tests or side by side tests with other products;
8. Provide any laboratory testing data; and
9. Provide an example of the product.

Rex Browning seconded the motion and the Committee voted in favor to table the review.

Proposed Rules Development

1. <u>Estimating Flows from Single Family Dwellings.</u>

The Committee packet information was reviewed. Information reviewed was:

a. Proposed rule language on minimum septic tank capacities;
b. Wastewater flow from various establishments;
c. Septic system permit information for 2000;
d. EPA OWTS Manual 2002 section on flow from single family dwellings;
e. State by state comparison of single family dwelling flow estimates;
f. A review of the issues the Committee previously discussed; and
g. Options for the Committee to consider.

The Committee discussed the problem of revising the method of estimating flows from single family dwellings. Everyone recognized the problem of applying the current sizing approach to large homes. The Committee recommended collecting information on premature failures and failures in general to attribute a cause for failure. The Committee recommended the use of water meters for non-premature failures to positively identify if wastewater flow and hydraulic overloading the system is the cause of the failure.

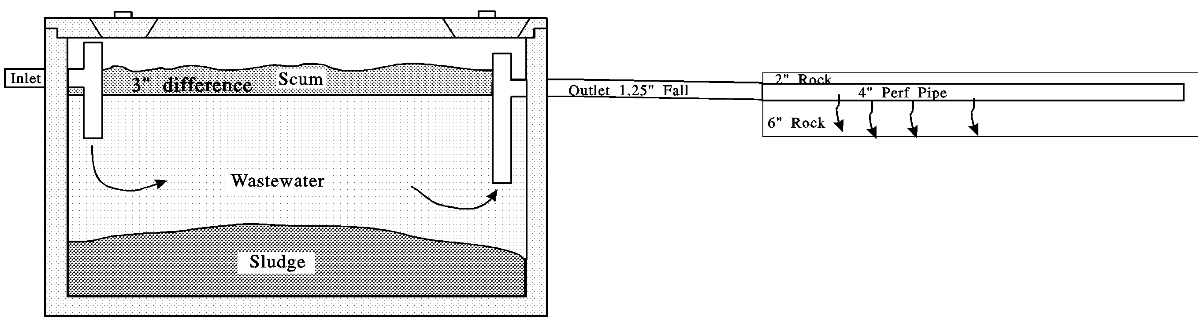
The Committee developed the following replacement/failing system data to be collected during the investigation process for issuing a replacement permit:

1. Date original system was installed or was last replaced;
2. Wastewater flow or water consumption use;
3. Type of system use: e.g. residential, commercial, multiple residential, recreational, etc….;
4. Existing and replacement system drainfield ft^2;

5. Soil type for failed system (from Permit) and soil type for replacement system; and
6. Original system and replacement type: drainfield, gravelless alternative, sand mound, ATU etc…..

The Committee recommended that the onsite coordinator propose to the Council of Environmental Health Directors that these data elements be collected and reported to DEQ and the TGC for use in developing revised rules. The current DEQ/HD MOU requires that the health districts and DEQ develop performance reporting for various programs and that the districts will provide to DEQ performance reports. These failing system data elements could be part of the performance reporting.

2. <u>Grade from the Septic Tank to the Drainfield.</u> The Committee discussed revising the standard system section rules to require that the fall from the septic tank to the drainfield be a minimum of 3 inches. The rational for the three inches of fall is to ensure that the entire profile of the drainfield is flooded prior to a backup from the septic tank to the house black waste line.



Septic Tank

Under the current design minimums, the drainfield is typically placed 10 feet away from the septic tank, with a 1/8 inch/ft of fall to the drainfield manifold. This places the drainfield 10/8" or 1.25 inches deeper than the invert of the septic tank outlet. When a back up begins to occur in the drainfield, the septic tank will start to be flooded prior to the entire sidewall area of the drainfield from being used (see figure). The drainfield will have 6 inches of effluent below the pipe, 1.25 inches of effluent in the pipe for a total sidewall area of 7.25 inches in the drainfield that is flooded. The tank will start to pond and the 3 inch difference between the inlet and outlet of the septic tank results in 10.25 inches of the trench sidewall being flooded at the point where there would start to be back up into the blackwaste pipe. This leaves 1.75 inches of trench sidewall yet to be used for infiltration when the wastewater starts to backup into the blackwaste pipe. By requiring a 3 inch fall from the tank to the drainfield, rather that the 1.25 inch fall, the entire drainfield will be flooded prior to wastewater backing up into the blackwaste pipe. When the entire drainfield sidewall (12 inches) is used there is 6 inches below the drainfield pipe, 3 inch fall from tank to drainfield, and 3 inches from the tank outlet invert to tank inlet invert.

Under current conditions when the standard drainfield is completely ponded, the wastewater is standing in the blackwaste pipe by 1.75 inches (6 inches in drainfield, 1.25 inches fall from tank to field, 3 inches of septic tank storage, and 1.75 inches of storage in the blackwaste pipe).

Notes: 1.) The dwelling blackwaste pipe is required by the plumbing bureau to have a fall of ¼ inch/ft and with a typical 10 foot pipe from cleanout to septic tank results in a fall of 2.5 inches. 2.) Experiencing of slow draining fixtures may be occur in the dwelling as a result of water use and the surcharge of wastewater in the septic tank.

Under the proposed change, when the standard drainfield is completely ponded there is no storage of wastewater in the blackwaste pipe (6 inches in drainfield, 3 inches fall from tank to field, 3 inches of septic tank storage). In most cases the result of requiring 3 inches of fall from tank to drainfield will be insignificant. Occasionally, a septic tank may need to be placed 1 ¾ inches higher in the soil profile in order to make grade to a drainfield that has restrictions to limiting layers.

The proposed change to the rule is to add a new row to the Subsurface Sewage Disposal Facility Table on page 122 of the TGM. The new row would be:

Item	All Soil Groups
Grade from the Septic Tank to Drainfield	3 inch Minimum Fall

3. Absorption Bed Criteria.

The Committee discussed the language in section 008.10 on absorption beds and decided that the word basic should be deleted from the proposed language changes. The committee recommends that consideration of all alternatives be given prior to issuing a permit for an absorption bed. This recommendation recognizes the importance for sidewall area in drainfield systems. The proposed language is:

> 10. Standard Absorption Bed. Absorption bed ~~disposal~~ treatment and distribution facilities may be considered when a site is suitable for a standard or ~~basic~~ alternative subsurface ~~disposal~~ treatment and distribution facility except ~~it~~ the site is not large enough.

The Committee discussed the use of absorption bed as a substitute for a standard system when property area is limited or restricted. By striking the work "basic" from the proposed rule text, this allows for the use of pressure distribution systems and absorption beds on the small lots that need to lift the effluent. The rules do not allow the use of absorption beds for large soil absorption systems.

4. Use of Equipment on Infiltrative Surfaces.

The Committee discussed the language in section 008.06 Excavation in relation to 6 foot wide trenches and the use of small excavator equipment on the soil infiltrative surface. Installers have used small excavator equipment (bobcats) on the infiltrative surface for placing gravel during construction of the drainfield. The equipment smears and compacts the soil reducing its infiltrative capacity. Remedies were to re-excavate the trench or scarify the compacted soils. Arguments from installers not wanting to remove gravel and re-excavate the trenches argue that the practice is not specifically prohibited by rule.

The Committee proposes the following revision to section 58.01.003.008.06 Excavation (TGM page 122):

06. Excavation. Trenches will not be excavated during the period of high soil moisture content when that moisture promotes smearing and compaction of the soil. Use of construction equipment or other activities that may compact the soil infiltrative surface is prohibited. Backhoes and smaller earth moving equipment are prohibited from being operated on the infiltrative surface.

New System Development - Constructed Wetlands

The Committee discussed the Subsurface Flow Constructed Wetland paper. The design in the paper is for use with single family residences and sets minimum standards for design and monitoring. The system could be used for either new or replacement systems. DEQ has some funds that could be used to collect and analyze wetland system effluent samples for treatment efficiencies. The Committee approved the Subsurface Flow Constructed Wetland paper as an experimental system. **See Appendix D** for a copy of the revised Subsurface Flow Constructed Wetland paper.

Issues from the field

A. Recording Easements. Joe Canning was asked by the committee to find out the minimum requirements for recording easements for onsite wastewater systems. The Board of Professional Engineers and Professional Land Surveyors (PE&PLS) replied back to the TGC that "if a survey is conducted in the field as required in Item #5 of the DEQ TGM, then the points must be monumented and a 'Record of Survey' prepared and recorded." The PE&PLS Board tells us that we need to have a record of survey prepared and recorded for easements. The easement site should be determined to be an acceptable location prior to preparing the easement document. If the site will not work, it makes no sense to prepare an easement. Once the site has been investigated and approved, the easement document can be drawn up, signed by both parties, recorded with the county clerk, and submitted to the District staff. The District staff can issue the permit once the signed and recorded easement is submitted. The system can be installed and the surveying and monumenting of the easement site completed and recorded as a final step in the inspection – approval process.

   Suggestions were made to strike some language in section 3 of the TGM Easement page 30-1 so that the districts could required recorded easements prior to issuing permits. This authority already exists. An application that proposes to use easement land (for primary or replacement drainfield areas or for other system components) that is not part of the legal description of the property, are to be considered incomplete applications (See section 005.04.b and l. of the rules). The districts shall ask for recorded easements or agreements as per the application section of the rules. The easement page provides criteria to complete the legal description. Surveying and monumenting the easement site can be completed after installation and a supplemental record filed with the county clerk.

B. Pumps and Electrical Code. The December 21, 2001 letter from the Electrical Bureau was reviewed as it relates to pressure distribution system electrical requirements for pumps, controls and alarms. Individual residential dosing chambers are considered unclassified (non-hazardous) by the National Fire Protection Association (NFPA) 820. Therefore the Electrical Bureau does not require the use of explosion proof box for the electrical connections. The Electrical Bureau does require a seal off and use of a weatherproof box.

However, multiple residential and commercial installations are considered classified as (hazardous) due to higher levels of flammable methane gases present. For commercial and multi-residential doing chambers the Electrical Bureau does require the use of explosion proof box and seal off. All septic system electrical equipment is required to be listed and installed in accordance to the National Electrical Code (NEC).

The TGC reviewed the pressure distribution system section and discussed making changes to the TGM in accordance with the recommendations received from the Electrical Bureau. A summary of the changes made to the pressure distribution system section are listed below:

TGM page 56, 5.c. Other Pump Considerations

- Bullet #3. Replace the text "compression coupling" with "unions".
- Bullet #4. Replace the text "State Electrical Department" with "Division of Building Safety, Electrical Bureau" and add at end of bullet "for multiple residential and commercial installations."

TGM page 58, 7. Dosing Chamber

- Revise the figure to indicate that a weatherproof box is acceptable for individual residential systems and that the conduit can be rigid nonmetalic schedule 80 PVC. Note that the explosion-proof box is required for multiple residential and commercial applications.

TGM page 58-9, 7.c Electrical Requirements:

- Revise language in 2) to reflect changes in electrical requirements and suggested language changes from the Electrical Bureau.
- Revise figure in 4) by adding "weatherproof or" to text describing electrical box (TGM page 59).
- Revise language in 5) and 6) to refer to the Division of Building Safety, Electrical Bureau.
- Revise figure in 6) to indicate the use of rigid or rigid nonmetalic (SCH 80 PVC) conduit is acceptable materials to run electrical wire, and add weatherproof to the descriptor for the connection box.

Joe Canning moved that the Committee issue **preliminary approval** for the changes in the TGM on pages 56, 58, and 59. Mike Reno seconded the motion and the committee voted in favor of the motion. Text and figures on TGM pages 56, 58 and 59 have been revised as suggested by the TGC in order to depict the requirements of the Electrical Bureau. **See Appendix E** for revised TGM pages 56, 58-59.

C. Septic Tank Reinforcement Design Standard – Addressed during the TGC Update Section discussion. See page 3, TGC Updates of these minutes.

D. Scaled Plot Plan Tools. The Committee discussed the suggestion of developing standardized or scaled plot plan tools. The suggestion was to develop a standardize ruler scaled with some of the separation distances, such as well to drainfield 100 feet, tank and drainfield dimensions, with a scale of 1inch = 20 feet. A hand out was reviewed. The Committee reviewed the materials and agreed that they would be helpful for homeowners with plenty of land to use for their system layout and design. The Committee was concerned that the tools might not work for parcels that have a minimum amount of land. Lots with tight dimensions need scaled plot plans prepared by the installer or Engineer. The materials could be used as a handout, but were not accepted for incorporation into the TGM.

E. ATUs and Trash Tanks. The Committee reviewed the following article: Converse, James. August 2001. Aeration Treatment of Onsite Domestic Wastewater: Aerobic Units and Packed Bed Filters. Small Scale Waste Management Project, 43 pages. The question posed to the Committee was "what are the requirements for use of tanks ahead of ATUs for Idaho?" The Committee determined that the ATU manufacturer should require as a minimum, the same tank design used to achieve NSF Standard 40 Certification. If the site-specific characteristics of the wastewater quality or quantity require surge capacity or storage of wastewater, then the manufacturer's recommendations should be followed for those site-specific projects.

   DEQ issued Guidance for Private Community or Central Wastewater Treatment Plants, See: http://www.deq.state.id.us/water/wastewater/guidance_PrivateWWTreatment.doc The guidance requires:

   > 3) For flow equalization ahead of the wastewater treatment plant, a properly sized tank with appropriate pumping should be provided.

   Influent flow rates need to be at a rate that the ATU is designed to process. Units that can't process the wastewater and fail to achieve the 30/30 mg/l BOD/TSS may need to include flow equalization. The need for flow equalization is different for each ATU, some will need it and some won't. Follow the ATU design recommendation for each project. Retrofit with additional tanks after all O&M methods have failed to achieve the BOD/ TSS limits.

F. Sand Mound Information. The Committee directed the onsite coordinator to make changes to the sand mound section of the TGM based on the latest research and to bring the changes back to the Committee at the next meeting.

G. Ranking Alternative Systems. The committee did not have time to review the concept of ranking alternative systems. This agenda item is held over for the next meeting.

H. Total Nitrogen Reduction. The committee did not have time to develop a policy on Total Nitrogen Reduction for alternative systems. This agenda item is held over for the next meeting.

I. Soil Compaction of the infiltrative surface. Addressed during the Proposed Rule Section Discussion. See page 6-7 Use of Equipment on Infiltrative Surfaces.

The committee adjourned at 5:00 pm

Appendix A.
Final TGC Minutes
December 4, 2001

TECHNICAL GUIDANCE COMMITTEE
FOR INDIVIDUAL AND SUBSURFACE SEWAGE DISPOSAL

December 4, 2001 MEETING MINUTES

PRESENT: Joe Canning, P.E., B&A Engineers
Rex Browning, Licensed Installer
Barry Burnell, EHS - DEQ
Dan Kriz, Environmental Health Director, SCDHD
Ken Babin, Supervisory EHS, PHD
Mike Reno, EHS – CDHD

GUESTS: Jim Nichols, Infiltrator Systems Inc.
John Robinson, Infiltrator Systems Inc.
Michael Lloyd, Ring/EZ Flow
Chris Duryea, Infiltrator Systems Inc.
Bill Morgan, Infiltrator Systems Inc.
Jeff Fereday, Infiltrator Systems Inc./Givens Pursley
Alex Mauck, EZ Drain
Cory Russell, Advanced Drainage Systems

The meeting was called to order at 8:35 am December 4, 2001. The coordinator provided a brief reminder to the guests of the purpose of the Technical Guidance Committee meeting and asked each individual to introduce themselves to the committee. The guests were asked to sign the sign in sheet and indicate if they were interested in presenting to the committee.

May 14, 2001 TGC minutes - review, amend, and accept.

Ken Babin suggested an amendment to the minutes. Mike Reno moved that the committee accept the minutes as amended. Rex Browning seconded the motion and the committee voted in favor of accepting the 05/14/2001 TGC minutes as final. **See Appendix A**.

TGC Preliminary Approval Review for Final Approval
A. TGC Revision - Septic Tank Construction Structural Reinforcement Specifications.
The committee discussed the preliminary approval to modify the septic tank structural reinforcement language in the TGM page 23. Lar-Ken has poured several tanks using the 1-½ inch polyethylene fibers as replacement to steel reinforcement. Pocatello Precast is using fiber reinforcement as well, but not as a substitute for steel reinforcement. The preliminary approval language was read:

> Reinforcing steel shall be ASTM A-615 Grade 60, fy=60,000 psi, details and placement shall be in accordance with ACI 315 and ACI 318 <u>or equivalent as certified by a licensed structural engineer.</u>

Ken Babin moved to accept for final approval the revised structural reinforcement language as presented in the TGM page 23 section 2.b. Joe Canning seconded the motion and the committee voted in favor of **final approval**. **See Appendix B** TGM page 23.

DEQ Update on Sizing Gravelless Trench Components

A. Public Comments Package Review.

The coordinator handed out copies of the public comments package to the TGC members, the Infiltrator Systems representative, EZ Flow representative, Jeff Fereday, and ADS representative. The coordinator presented a brief summary of the six public comments received. The comments received were:

1. Health District reports on system failures,
2. Bob Backman letter,
3. Chris DiTullio, Cultec Inc letter,
4. Dick Bachelder, PSA, Inc letter,
5. Michael Lloyd, EZ Flow E-mail and attachment, and
6. Jeffrey Fereday, letter with Infiltrator attachments 1, 2, and 3.

B. DEQ Draft Proposed Gravelless Trench Sizing Method.

The coordinator handed out a draft proposed gravelless trench sizing paper and presented the proposal to the TGC. (**See Appendix C**) The committee discussed the proposed sizing approach.

C. Presentations by Manufacturers.

Jim Nichols (Infiltrator Systems Inc.) and Michael Lloyd (EZ Flow) were each given 30 minutes to present information to the TGC for their consideration.

1. Jim Nichols, Infiltrator Systems Inc. Supports the use of infiltrative area and storage volume as two factors in sizing drainfields. Infiltrator recognizes that gravel drainfields are the standard system in Idaho. Mr. Nichols presented his interpretation of how Darcy's Law should be applied to drainfield systems. Mr. Nichols presented the findings of Dr. Robert Siegrist, Colorado School of Mines. Mr. Nichols presented that in Darcy's Law the variable studied in Siegrist's work was area. Area was the variable in the study based on preparing half of the test columns with gravel and the other half without gravel. Construction details of the columns used in the study were presented along with findings. It was reported that Siegrist's work demonstrates that columns without stone had higher flow rates by 2.4 times or equivalent to a 41% reduction in drainfield size. Mr. Nichols presented that no fines were used in this study, but that the first layer of gravel in the columns was covered by sand to simulate gravel dropped into a trench. Mr. Nichols noted that fines form a restrictive layer. Next Mr. Nichols presented a suggested sizing for a gravel drainfield. His demonstration used a 3-foot wide, 10-inch high trench for 56 inches or 4.67 ft^2 of infiltrative area. Using Siegrist's flow rate of 41%, the stone trench is given 1.91 ft^2/ft of area (4.67 ft^2/ft x 0.41 = 1.91 ft^2/ft). Comparing this to the drainfield sizing of 3 ft^2/ft results in a sizing factor that can be applied to all alternative systems. 3ft^2/ft divided by 1.91 ft^2/ft results in a sizing factor of 1.57. This figure is recommended to be used along with system open area to determine application area.

Storage is recommended to be a secondary factor. The suggestion was to first compare infiltrative surface area, and if the surface areas are equal to or better than stone then look at storage area. If storage area is lower than stone then the committee should add more length to the system.

A question and answer period was held with the committee regarding Mr. Nichols presentation. Mr. Nichols agreed to provide to the committee the open area on the side of the Infiltrator Products. Problems with installations in sandy soils were discussed. Mr. Nichols indicated that the company has a required minimum number of infiltrator standard units to be installed in sand or to use the EQ 36 product in order to take advantage of the higher louver height. Mr. Nichols was asked about installations of infiltrator products on ASTM-C-33 medium sand. The reply was to moderately compact the medium sand fill to prevent chambers from settling into the sand. Rex Browning provided examples of systems that he has installed. Mike Reno asked which states provide a reduction, what percentage reduction is granted, and for which products. Mr. Nichols agreed to provide to the committee the requested information.

2. Michael Lloyd, EZ Flow – Ring Industrial Group. Clarified that the National Onsite Advisory Board (NOAB) consists of Dr. Larry West (soil scientist, Univ. of Georgia), Dr. Robert Rubin, (environmentalist, NC State Univ.), and Dr. Kevin White (civil Engineering, Univ. of S. Alabama) this group of scientists were not paid by Ring Industrial Group. The paper that was prepared was based on their research and was a copy of material submitted to Georgia. Mr. Lloyd stated that the purpose of the drainfield was to provide infiltrative area, storage of septic tank effluent during periods when wastewater flow exceeds infiltration rates, and to support the overlying soil. Mr. Lloyd presented the soil principals in Darcy's Law. Hydraulic conductivity (K) is the measure of resistance R=l/k, with l being thickness. The variable that determines flow through soil is the resistance or the sum of the hydraulic conductivities. I and A are kept constant in Darcy's Law, with K being the variable. Reference was made to the hydraulic conductivity paper (public comment #5). Mr. Lloyd indicated that the fines in a system with a biomat developed would control the flow rate into the soils. If the fines are removed then the flow rate increases by 30-60%. Mr. Lloyd asked that the committee look at all of the sciences and that if you remove the fines then there is no masking. Q is the same in column studies w/o the addition of fines. The K of the biomat layers is the factor determining infiltration rate into the soils.

The NOAB sizing looks at all three infiltrative surfaces, the bottom area has an infiltration rate of 50% because of the hydraulic conductivity of the fines biomat, the two sidewall areas have infiltration rates at 75% as a margin of safety. Applying this sizing to a standard 3 foot wide gravel drainfield results in a bottom infiltrative area of 3 ft^2/ft x 0.50 = 1.5 ft^2/ft, and a side wall area of 2 x 1ft^2/ft x 0.75 = 1.5 ft^2/ft for a total of 3.0 ft^2/ft. Applying this approach to 12-inch diameter tube the approach is to use the circumference of the tube as the infiltrative surface area or 3.1 ft^2/ft or call it 3.0 ft^2/ft. These systems do not have fines, the biomat will form at the soil, and the hydraulic conductivity will be higher than a gravel system with fines.

The committee asked Mr. Lloyd questions about his presentation. Mike Reno asked which states provide a reduction, what percentage reduction is granted, and for which products. Mr. Lloyd agreed to provide to the committee the requested information, and the NOAB presentation. The committee asked questions about biomat development with soils, fines and gravel. Mr. Lloyd indicated that the source of fines is from the gravel and is similar to the sands used in the Siegrist study. The fines are the cause of the decreased in hydraulic conductivity. Mr. Lloyd presented information on use of storage volume. Soils have a void volume of 30%. Surge volume is used in Georgia at a rate of 1.5 times the storage volume of a gravel drainfield. Mr. Lloyd pointed out the O.D. (12") and I.D. (8") of large diameter pipe and suggested that the louver height of domed chambers is the same as the slits in large diameter pipe.

The committee decided to limit presentations to the single thirty-minute period for each group and that any other comments could be directed to the committee in writing.

The coordinator indicated that the DEQ will go through an additional public comment period and that DEQ would decide about suggesting guidance for sizing gravelless trench systems or if rulemaking should be initiated. Ken Babin suggested that the formula for sizing gravelless trench systems should only go to rulemaking if universal acceptance. The rational is that rulemaking is a longer process (10 years between rule updates) to make changes should the formula need to be modified. Interim to rulemaking the committee could adopt formula as guidance. Rex Browning suggested that each company prepare a sizing formula and apply it to the gravelless trench products. The committee discussed the public comment period and agrees to keep the comment period short. The committee recommended to DEQ to have a 45-day comment period, after which time the DEQ would review comments and reconvene the committee shortly thereafter.

Jeff Feredey pointed out that in his opinion if the DEQ decides that the sizing formula should go through rulemaking that it would be inappropriate for the committee to adopt an interim sizing formula. Joe Canning concern with the sizing formula proposed by DEQ awards too much credit for storage volume. Joe Canning suggested that storage volume greater than 1.5 times the daily flow should be the maximum and anything above this should not be awarded additional credit. Rex Browning encouraged the DEQ to consider the function of stone supporting pipe and sidewall as a component to sizing.

The committee recommends to DEQ to initiate a 45 day public comment period on the proposed draft gravelless trench sizing; for DEQ to review the submitted information and to decide if rulemaking or guidance is appropriate and to reconvene the committee before the next construction season.

Product Reviews

1. ADS Multipipe 9 and 11. The coordinator informed the committee that DEQ did not accept the approval issued for ADS Multipipe 9 and 11 based on the sizing using the originally proposed sizing method.

The committee was given a packet of information from the ADS company requesting approval for use in Idaho of the Bio2 and Bio3 products. The committee reviewed the information submitted by ADS for their Bio2 and Bio3 products. These chamber designs are similar to infiltrator EQ24 and EQ 36. Mr. Nichols informed the committee that the Bio2 and Bio3 have less open surface area on the sidewalls and have some minor structural differences. The committee discussed the previous sizing method for domed chambers. Mike Reno moved that the committee accept the Bio2 and Bio3 as approved products using the current sizing as being equal to 2 and 3 foot wide trenches respectively. Joe Canning seconded the motion and the committee voted in favor of granting product approval. The suggestion was to notify ADS on the sizing issue. The company through Dick Bachelder has submitted comments on the proposed gravelless trench component sizing.

The committee reviewed the ADS Multipipe 9 and 11 products in relation to existing products of the exact same size, shape, and capacity. Ken Babin moved to accept the ADS Multipipe 9 and 11 based on existing sizing factors. Joe Canning seconded the motion and the committee voted in favor of granting product approval.

2. EZ Drain Co. Sizing for various product configurations. The committee was given a packet of information from EZ Drain Co. requesting approval of various product configurations for use in Idaho. EZ Flow/Drain Co withdrew there request for committee approval of the different product configurations due to the suggested sizing being based on the rejected sizing method.

3. SimTech Bristle Filter. The committee was given a packet of information from the company requesting approval for use in Idaho as an effluent filter. The committee discussed effluent filter approvals and reviewed the previous requirements established for effluent filter approval. The committee has previously approved effluent filter if they have passed the NSF Standard 46 protocol. Effluent filter manufacturers, approved prior to NSF adopting Standard 46, were given three years to achieve certification by the committee. The committee decided not to approve the SimTech Bristle Filter until such time that the company completes NSF standard 46 testing.

The committee adjourned for lunch.

The committee reconvened the meeting at 1:10 pm.

Product Reviews continued.
4. EcoFlo video was viewed. The EcoFlo system is a peat filter placed over an absorption bed. The peat provides a medium for effluent treatment prior to absorption into the soils below the systems. The peat is replaced every 8 years. The committee had a concern over disposal of the spent peat materials. The video was provided for informational purposes only as no request for approval has been received.

TGC Updates (from 05-14-01 mtg)
The committee reviewed the final approvals from the May 14, 2001 meeting (**see Appendix D**). The coordinator presented to the committee the following TGM pages:

Policy # 2000-1	Page 139-1
Policy # 2000-2	Page 139-2
Pipe Materials	Page 78-6, and page 22
Effluent Filter Design	Page 58
Fill Material	Page 16
Soil Design Subgroup Corrections page 9	
Unstable Landforms	Page 18-6 and 18-7
Drainfields	Page 24
General Requirements	Page 27
O&M requirements	Page 29
Extended treatment package systems page 39	
Lagoons Inspection	Page 46
Pump Vaults	page 59-1

A suggestion was made that the committee three hole punch these pages and insert them into their TGMs. The Health District and DEQ regional offices will be sent a copy of the updates to be distributed to their staff. The next planned update for the TGM is April 2002.

Mike Reno discussed the fill material section. A concern was raised that this section would be used to modify sites that are seasonally flooded. The committee indicated that use of the fill material section of the TGM is not an appropriate method to use on sites that are seasonally flooded. These locations may be in flood plains and may have U.S. Army Corp of Engineers (USACE) jurisdictional issues regarding the filling of wetlands. Any fill on a wetland may require Clean Water Act Section 404 permits. Applicants should be directed to the USACE for fill proposals on wetlands. It was pointed out that site modifications under this section do not guarantee that SSDS permits will be issued.

O&M Corporation Documents

1. Capital Extended Treatment Inc. The coordinator had provided to the committee Capital Extended Treatment Inc., O&M documents and asked if the committee had any review comments. The AG's office has provided review comments and the coordinator has reviewed the septic tank design plans and found them to be inadequate.

The committee discussed the installation of extended treatment package systems in relation to installations for sand mounds, ISFs and RGFs. The committee recognizes that the biggest challenge for O&M companies will be the transition from the current board of directors to new board when the individuals retire from installation and service. The committee looked at a best and worst case scenarios for transition and discussed the pros and cons of extended treatment package systems.

The committee also discussed current problems with extended treatment package systems O&M entities. Tracking and following up on problems, sampling systems, and annual O&M reporting. The coordinator offered to issue a letter to the O&M entities reminding them of their annual O&M reporting obligation.

2. O&M Corporation New Item #26. The AG's office recommended that the committee should go through the rulemaking process to add a new item to the list of O&M entity requirements. The committee discussed the various approaches O&M entities have used to enter into service agreements. In one case an individual signed the service agreement contract as both the O&M director and as the service provider. Some entities have used family members, sons or brothers, to sign the service agreement. The committee decided that this issue did not warrant the rulemaking process and decided to drop adding a new item to the list of requirements.

Proposed Rules Development

Reasonable Access to the Central Wastewater Facilities (58.01.03.005.05.e). The coordinator presented to the committee a handout composed of the following items: letters DEQ issued to District 7; a District 7 letter to the coordinator; the Valley Advocates for Responsible Development Appeal; a draft DEQ WebPages announcement; a draft DEQ letter requesting public comments; and a spreadsheet outlining proposed factors to consider when making reasonable access determinations. The coordinator explained the issues in Teton County, how the appeal was filed, and the actions DEQ and the AGs office is taking to have the appeal withdrawn. The committee discussed examples of when the health districts have made reasonable access determinations and the flexibility the current language offers staff in making access determination decisions. The language was intended to be vague so that the various factors could be used in making a decision. The committee recommends to the DEQ to leave the language as it is written so that the Director or his designee can make the decisions. Examples of annexation, city property boundaries, development housing density, and land use planning decisions all are factors that affect when a sewer service is available. Environmental considerations need to be the main focus of reasonable access decision making. Ground water quality rule and water quality concerns need to be primary considerations. DEQ should comment on P&Z documents, but land use planning needs to remain a local issue. DEQ should not make this a statewide issue.

The committee reviewed the VARD appeal and the draft spreadsheet of conditions to consider when reviewing projects for reasonable access to central wastewater facilities. The committee recommended that DEQ not undertake a rulemaking or develop guidance for the TGM that restricts reasonable access decisions making. The committee recognizes the site-specific factors that are involved in making reasonable access decisions. The economics of land development was recognized as an issue a developer must deal with in preparing subdivision plats. The costs of development are passed on to the property owners and the DEQ should discount economic factors in making these types of decisions and weigh more heavily on the environmental impacts. The committee also recommended that low interest loans for wastewater transmission lines should come with conditions that address land development conditions and connecting into the system being financed with SRF loans.

The coordinator reported to the committee that it does not qualify as a rulemaking body. DEQ will have to go through the APA process of setting up a rule making committee. DEQ would use the committee's recommendation as a draft rule to present to the rule making committee. Members of the TGC could also serve as members of the rule making committee.

New System Development

A. Graywater System Re-review. The coordinator presented to the committee the proposed graywater system for re-review. The committee discussed the proposed graywater system and the added interest in using these types of systems for water reuse. The committee reviewed the proposal and asked that the UPC holding tank information be added. The committee also discussed mini-leach fields and pump systems. Joe Canning moved that the committee grant preliminary approval of the revised graywater system. Dan Kriz seconded the motion and the committee voted in favor of granting **preliminary approval** for the graywater system. **See Appendix E**.

B. Constructed Wetland Update. No progress on the constructed wetland demonstration project. The state has some funding to install two experimental constructed wetlands and to conduct sampling of the influent and effluent from each wetland.

C. Drip Irrigation Working Session. The coordinator provided to the committee a draft drip distribution system handout. The drip lines are pressurized with effluent from the septic tank after passing through specially designed filtration systems. Typical components include a septic tank, pump tank with dosing pump, flushable 100-micron disk filter, flow meter, programmable logic controller, and a network of shallow drip distribution lines. The committee reviewed the literature summaries and viewed an installation video. The Mineral Mountain Rest Area on Highway 95 is having system problems and ITD planners are considering the use of drip distribution. The committee reviewed and amended the draft drip distribution system. Joe

Canning moved to grant preliminary approval of the amended drip distribution system. Dan Kriz seconded the motion and the committee voted in favor of granting **preliminary approval** for the drip distribution system. **See Appendix E.**

Issues from the field

A. NSFC Database. The National Small Flows Clearinghouse (NSFC) maintains six databases that provide information about all aspects of sewage treatment. Two of these databases can now be searched online at http://www.nesc.wvu.edu/nsfc/nsfc_databases.htm : the Bibliographic and Manufacturers and Consultants Databases. The Bibliographic Database stores thousands of articles dealing with onsite and small community wastewater collection, treatment, disposal, and related topics. The articles are collected from more than 90 journals and magazines, as well as conference proceedings, U.S. Environmental Protection Agency (EPA) documents, and research papers. The Manufacturers and Consultants Database houses a list of industry contacts for wastewater products and consulting services. This database serves both as a reference for engineers, private citizens, and small community officials and a referral database for wastewater products and trade items.

B. Permitting Extended Treatment Package Systems (ATUs). A letter from Panhandle District Health was shared with the TGC and asked for guidance from the TGC on writing permits for extended treatment package systems. The difficulty is getting the signed and recorded membership agreement and easement from the applicants. The issue stems from writing permits with options for systems that can be installed. During the site evaluation it is common for the permit to be issued for ATUs, ISFs, or RGFs. Builders are also making applications for on-site systems and if the choice is to go with an ATU the builder cannot not sign the membership agreement and easement documents for the property owner. Builders that are speculating on selling a property and own the property, may sign the agreements and have them recorded, as they are the property owner at the time the documents are recorded.

The committee recommends the following process for issuing septic system permits. 1. Conduct the onsite evaluation. 2. Inform the property owner by letter or onsite report of the findings of the onsite evaluation. Indicate in the report which systems a permit may be issued. 3. Property owner selects option to be installed, has plans and specifications prepared (sand mounds, ISFs, RGFs), signs and records membership agreement (ATUs) and easement documents, 4. Property owner submits a completed application for a septic system. 5. Health district issues a permit after all elements of the application have been submitted.

Note sections 58.01.03.005.04. h, l, and o (TGM pages 105-106) require the property owner to:
h.) Submit plans and specifications of the proposed system,
l.) Provide copies of legal documents relating to access (easements) and to the responsibilities for operation, maintenance, and monitoring (O&M membership agreement), and
o.) Any other information, document, of condition that may be required to substantiate that the proposed system will comply with applicable regulations.

C. Abandoned Systems. The question from the field is for assistance in interpreting the abandoned system. Page 98 of the TGM defines abandoned system to be a system which has ceased to receive blackwaste or wastewater due to diversion of those wastes to another treatment system or due to termination of waste flow. The TGM interprets this definition at page 30 of the TGM. An abandoned system is considered to be a system that has not received wastewater flows or blackwaste for one year or more. The PHD has been advised that they cannot deny an occupancy permit for a structure that is replacing the same use and same size. The issue is non-conforming systems that are abandoned and reissuance of permits for new construction. Element #4 of the guidance instructs the applicants that if the system is an unapproved system it must be uncovered, pumped and inspected. It must meet all the current requirements, including issuing of a new permit. The committee instructs the health districts to follow these guidelines.

D. Easements and Monumenting Corners. The concern expressed is that "monumenting" corners of easements is too expensive for the applicants and that simple staking and surveying (describing) the corners should be sufficient. The committee turned to Joe Canning for his opinion of easement work. The TGM (pg 30-1) informs the applicant that the easement is to be surveyed and recorded (item 3) and a survey, including monumenting the corners, of the proposed easement site shall be made to supply an accurate legal description of the easement (item 5). The committee's intention was to establish a legal process to identify easement locations. The process needs to be repeatable and the corners of easements marked sufficient enough to avoid problems when properties change hands. The concern is when property is sold and the new owners are not supportive of the easements previous land owners had entered into, that the monumented corners may need to be surveyed (described) so that they can be relocated in case they are removed. The committee discussed monumenting as physical evidence of a corner and surveying as defining and setting land boundaries for the purpose of property sales. Joe Canning was given the assignment to look up the practice of surveying, and monumenting as defined in Idaho Code or the rules for land surveyors and to report back to the committee. Item number 5 of the Easement section of the TGM may need to be revised.

E. Travel Trailer Wastewater Flow. Wastewater flow rates from travel trailers (125 GPD TGM pg 114) is being questioned and clarification is asked as to the TGC's recommendation on wastewater flows. Various flow rates are being submitted for travel trailers. The coordinator reported that a comparison was completed of various wastewater texts estimates and metered flows. The following table lists by source the recommended wastewater flow rates in GPD.

Source	Wastewater Flow Estimates (GPD)
IDAPA 58.01.03.007	125
EPA 1977 (est)	150/trailer
EPA 1980 (est)	32 gal/per/day campground
Metcalf & Eddy, 1991 (est)	75-150 (2.5 people) 125 ave. per trailer
Manual of Septic Tank Practices (est)	50/space w/o sewer and water
Goldstein, 1973 (est)	50 gal/capita/day
Americana Campground (1994 metered)	50/unit discharge is to central sewer
Atlasta RV Park (1994 metered)	220 discharge is to central sewer
On The River RV Park (1994 metered)	85 discharge is to central sewer
Hi Valley RV Park (1994 by design)	40 gal/person discharge is to central sewer

Travel trailer park on-site system should be sized at 85 GPD per travel trailer with full water and sewer connections. If there is a strong likelihood that the park will be used for year round residences (Atlasta RV Park) then the higher flows should be used.

F. Bonding. An installer requested consideration of secured bank accounts or escrow accounts co-signed by the health districts as opposed to bonding. The installer making the request had his bond cancelled. The AG's office reviewed this issue and concluded that the rules requiring bonding and that no other option is available. The committee was not interested in developing a proposed rule allowing an alternative to bonding.

The committee did not have time to develop a policy on Total Nitrogen Reduction for alternative systems. This agenda item is held over for the next meeting.

The committee adjourned at 5:00 pm

Appendix B.
Drip Distribution System

DRIP DISTRIBUTION SYSTEM

Description: A small-diameter flexible piping network with emitters to discharge filtered effluent into the root zone of the receiving soils. The system is composed of a septic tank, (optional pretreatment system: Intermittent sand filter /Recirculating gravel filter, Extended Treatment Package System), filtering system (cartridge, or disk filters), a dosing system and process controller. Typical components include a 1,000 gallon septic tank and a 1,000 gallon pump tank, (optional pretreatment system), an effluent dosing pump, flushable disk filter, a flow meter, a programmable logic controller, and a network of shallow, self cleaning drip irrigation lines.

Conditions of Approval.

1. Drip distribution drainfields shall only be installed at locations that meet the criteria in the site suitability subsection of the rules (58.01.03.008.02 and 58.01.03.013.). The effective soil depths that are established for alternative pretreatment systems may be applied to drip distribution systems (when pretreatment systems are used).

Design.

1. Application rates up to 2 ft²/ft of drip irrigation line may be used.
2. Drip lines may be placed on a minimum of two-foot centers.
3. Drip lines are placed directly in native soil at a depth of 6 to 18 inches with a minimum final cover of 12 inches. The design application rate is based on the most restrictive soil type encountered within two feet of the drip lines.
4. Septic tank effluent is required to be filtered with a 100-micron or smaller disk filter prior to discharge into the drip piping system.
5. Drip laterals are flushed once every two weeks to prevent biofilm and solids build up in the piping network. Minimum flushing velocity is 2 feet/second at the return ends of the distribution lines and in the drip irrigation tubing during field flush cycles and long enough to fill all lines and achieve several pipe volume changes in each lateral.
6. Minimum of two vacuum relief valves per zone. Valves are located at the highest points on both the distribution and return manifolds. Vacuum relief valves are located in a valve box, adequately drained, and insulated to prevent freezing.
7. Pressure regulators/pressure compensators are to be used on sloped installations. Pressure is to be between 25 and 40 psi. Pressure regulators/pressure compensators are located at the manifold of each zone where varying topographies exist. Pressure compensating emitters must be used on sloped installations.
8. Return manifold is required to drain back to the septic tank.
9. Timed dosing is required. Timed or event counted backflushing of the filter is required.
10. Filters, flush valves, and pressure gauge may be placed in a head works (between pump chamber and drip field). Each component is required to be insulated to prevent freezing.
11. System must be designed by an Idaho licensed professional engineer.

DRIP DISTRIBUTION SYSTEM (Cont'd)

Construction.

1. No wet weather installation. Excavation and grading are to be completed before installation of the subsurface drip system. Drip systems may not be installed in unsettled fill material.
2. No construction activity or heavy equipment may be operated on the drainfield area other than minimum to install the drip system. Do not park or store materials on drainfield area.
3. Horizontal spacing between drip lines shall be as specified and installed at the depth specified. Note for freezing conditions: the bottom drip line must be higher than the supply and return line elevation at the dosing tank.
4. All PVC pipe and fittings shall be PVC sch 40 type 1 rated for pressure applications. All glued joints shall be cleaned and primed with purple (dyed) PVC primer prior to being glued.
5. All cutting of PVC pipe, flexible PVC and/or drip tubing shall be accomplished with pipe cutters. Sawing of PVC, flexible PVC and/or drip tubing shall be followed by cleaning all shavings or sawing shall not be allowed.
6. All open PVC pipes, flexible PVC and/or drip tubing in the work area shall have the ends covered with duct tape during storage and construction to prevent construction debris and insects from entering the pipe. Prior to gluing all glue joints shall be inspected for and cleared of construction debris.
7. Dig the return header ditch along a line marked on the ground and back to the septic tank. Start the return header at the farthest end from the dosing tank. The return line must slope back to the treatment tank or septic tank.
8. Prior to start up of the drip distribution system the air release valves shall be removed and each zone in the system shall be flushed as follows:
   A. Using an appropriate length of flexible PVC pipe with a male fitting attached to the air release connection to direct the flushing away from the construction area,
   B. Flush the zone with a volume of water (clean water to be provided by contractor) equal to 1.5 times the volume of the pipes from the central unit to the air release valve or the equivalent of five minutes of flushing, and
   C. Repeat this procedure for each zone (the flushing of the system is accomplished by manual override of the control panel by the manufacturer or engineer.)
9. If existing septic tanks are to be used, they shall be pumped out by a commercial septic tank pumper, checked for leakage or other problems, and replaced if necessary. After the tank is emptied, the tank shall be rinsed, pumped, and refilled with clean water. Debris in the septic tank shall be kept to a minimum since it could clog the disk filters during startup. (Disk filters are not backflushed during startup as any clogging could cause incorrect rate of flow readings for the controller.)
10. Once completed, drainfield area for shallow installations (less than 12 inches) are to be capped with 6-8 inches of clean soil and suitably revegetated.

Inspection.

1. System must be inspected by an Idaho licensed professional engineer.
2. Turn on pump and check pressure at the air vacuum breaker. Pressure should be between 15 and 45 PSI.
3. Check system for leaks; record flow measurements and pressure readings at start up.

DRIP DISTRIBUTION SYSTEM (Cont'd)

Example: Suggested Design

1. Determine square feet needed for the drip distribution system. Wastewater flow in GPD is divided by the soil application rate (based on the soil classification from an on-site evaluation). The result is the ft² needed for the system.

   Example: three-bedroom home in C-2 soils.
   250 GPD/0.2 gal/ft² = 1250 ft²

2. The system design is to use an application rate of 2 ft² per foot of drip line. Divide the required ft² by the drip line application rate (2 ft²/ft) to determine the length of drip line needed for the system.

   1250 ft² / 2ft²/ft = 625 ft of drip line.

3. Determine the size of pump based on GPM (step 3) and total head (step 4) necessary to deliver dose to system. Determine pumping rate by finding the total number of emitters and multiplying by the flow rate per emitter (1.32 gal/hr/emitter at 20 psi). Adjust output to GPM and add 1.5 GPM per connection for flushing.

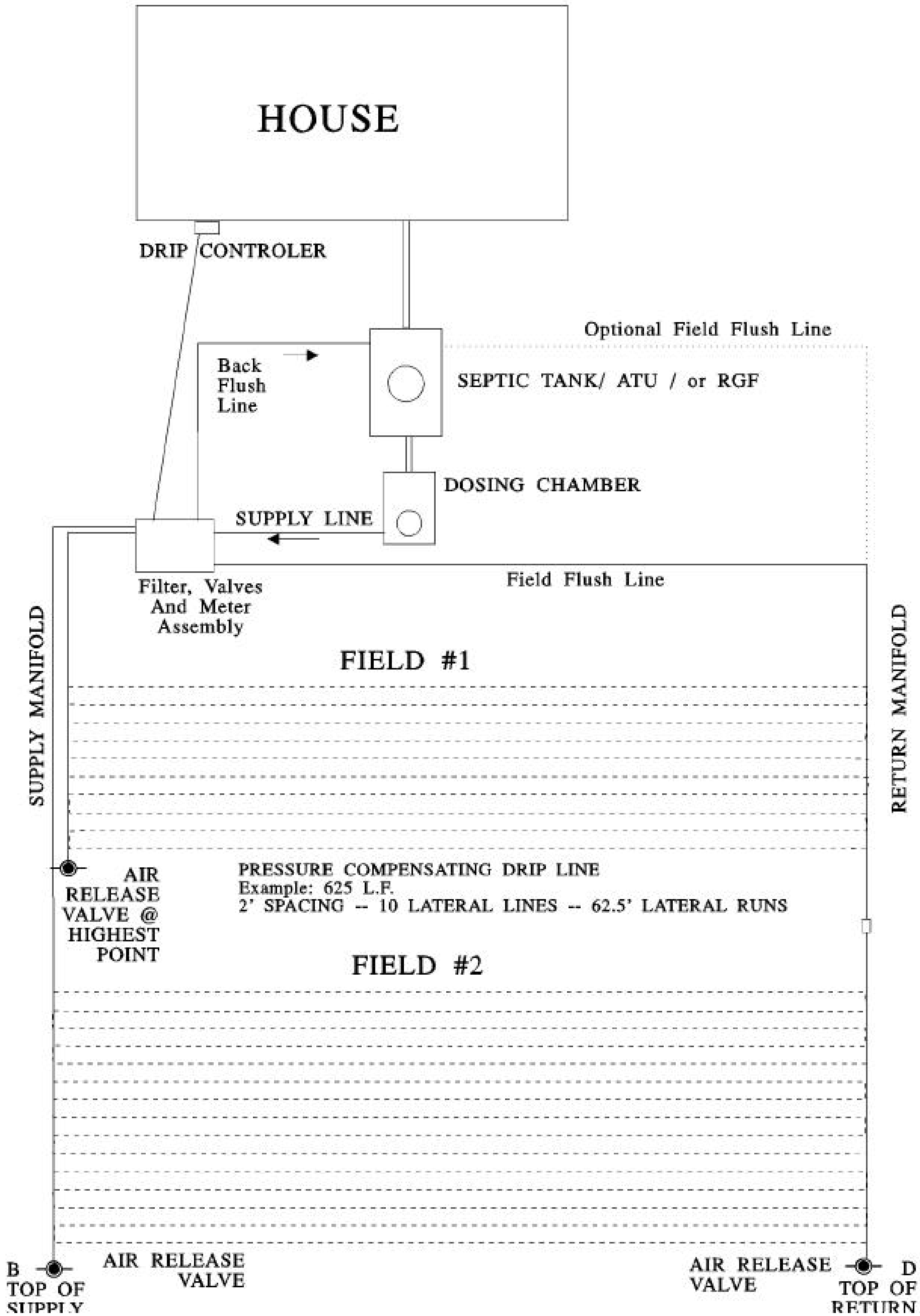
   625 ft / 2 emitters/ft = 312.5 use 315 emitters
   315 emitters x 1.32 g/hr/emitter = 415.8 gal/hr
   415.8 gal/hr / 60min/hr = 6.93 GPM or 7GPM
   10 connections at 1.5 GPM/connection = 15 GPM

4. Determine feet of head. Multiply the system design pressure (20 psi is standard, but values can be between 10 and 60 psi dependant upon drip line used) by 2.31 ft/psi to get head required to pump against.

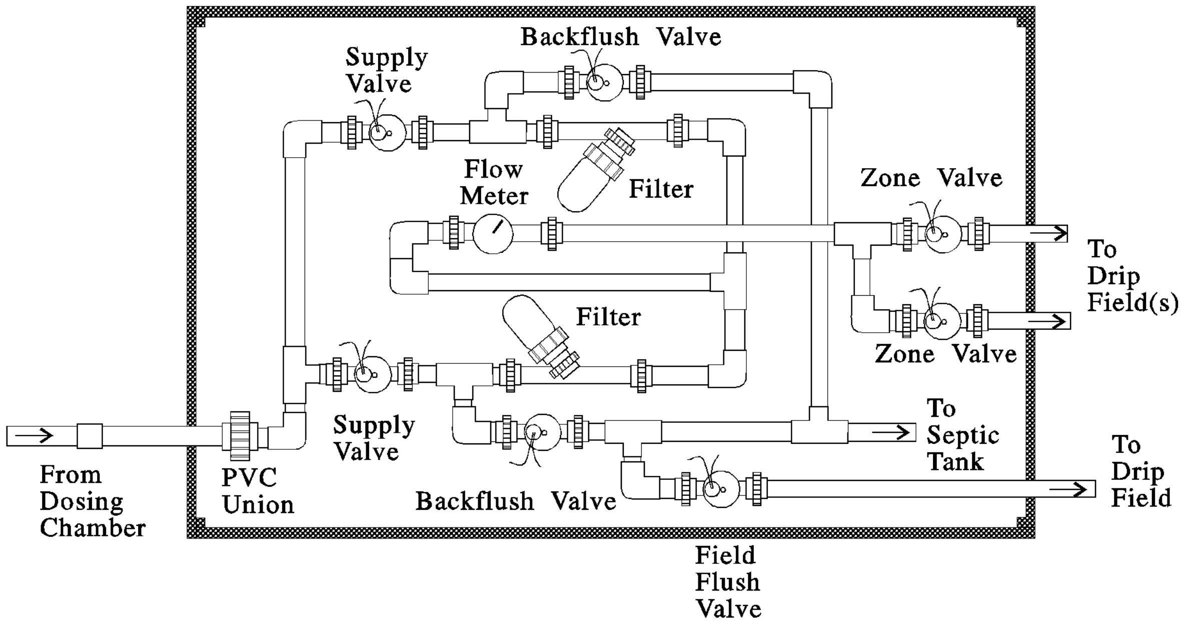
   20 psi x 2.31ft/psi = 46.2 ft of head. Add in the frictional head loss from piping.

5. Select a pump. Pump selected must achieve a minimum of 22 GPM plus the flush volume at 46.2 ft of head.

DRIP DISTRIBUTION SYSTEM

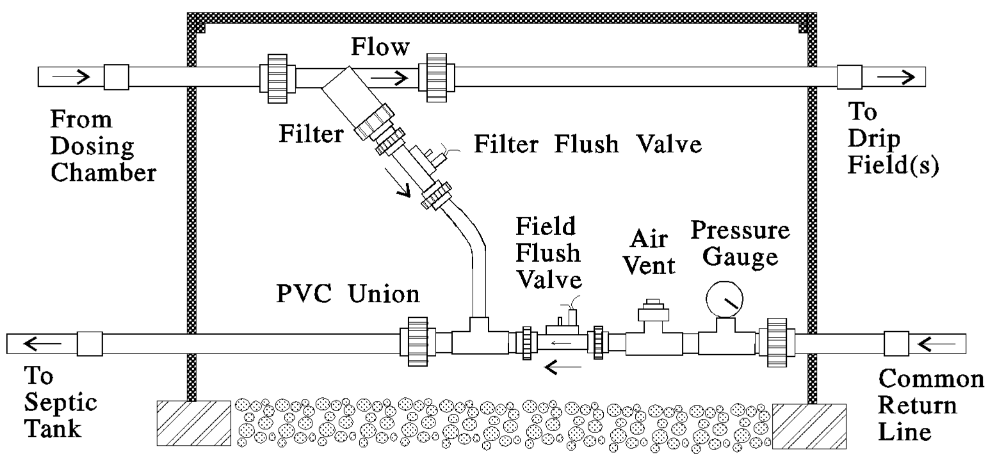


Valve Box Examples



Example of Filter, Valve and Meter Assembly.

Valve Box



Example of Filter, Valve and Meter Assembly.

Appendix C.
Graywater System

GRAYWATER SYSTEM

Description. Graywater is untreated household wastewater that has not come into contact with toilet waste. Graywater includes used water from bathtubs, showers, bathroom wash basins and water from clothes washing machines and laundry tubs. It shall not include wastewater from kitchen sinks, water softeners, dishwashers or laundry water from soiled diapers. A graywater system consists of a separate plumbing system from the black waste and kitchen plumbing, a surge tank to temporarily hold large drain flows, a filter to remove particles that could clog the irrigation system, a pump to move the graywater from the surge tank to the irrigation field, and an irrigation system to distribute the graywater.

Conditions for Approval.

1. Graywater treatment and disposal systems must meet all the separation distance setback criteria and soil application rate criteria as found in the rules.

2. Specialized plumbing designs will need to be approved by the Division of Building Safety, Plumbing Bureau.

3. Graywater surge tanks must be watertight and non-corrosive.

4. Operations and Maintenance manuals must be provided to the owner of the property.

5. Graywater may not be used to irrigate vegetable gardens.

6. The capacity of the septic tank and size of the blackwaste drainfield and replacement area shall not be reduced by the existence or proposed installation of a graywater system servicing the dwelling.

7. Graywater shall not be applied on the land surface or be allowed to reach the land surface.

Design Requirements:

1. Graywater flows are determined by calculating the maximum number of occupants in the dwelling, based on the first bedroom with two occupants and each bedroom thereafter with one occupant. Estimated daily graywater flows for each occupant are:

Showers, bathtubs, and wash basins (total)	25 Gal./Day/Occupant
Clothes washer	15 Gal./Day/Occupant

   Multiply the number of occupants by the estimated graywater flow.

   Ex. Three-bedroom house will have a design for four (4) people. The house has a clothes washer connection, then each occupant is assumed to produce 40 Gallons of graywater per day, resulting in a total of 160 gallons per day.

2. The following formula is used to estimate the square footage of landscape to be irrigated:

$$LA = \frac{GW}{ET \times PF \times 0.62}$$

where: GW = estimated graywater produced (Gallons per Week)
LA = Landscaped area (ft^2)
ET = Evapotranspiration (inches per week)
PF = Plant Factor, based on climate and type of plants either 0.3, 0.5, or 0.8
0.62 = conversion factor (from inches of ET to gallons per week)

Example. If ET = 2 inches per week, and lawn grasses are grown with a PF of 0.8 (high water using) then the landscaped area is equal to: LA = (160 GPD x 7 Days)/ (2 x 0.8 x 0.62) = 1,129 ft^2 of lawn.

3. An alternative to using graywater for lawns is to irrigate landscape plants. A plant factor is dependent upon the type of plants to be watered, an ET rate, and plant canopy. The following table can be used to calculate square footage of landscape plants that are able to be irrigated with graywater:

ET (Inches per Week)	Relative Water Need of Plant	Gallons per Week 200 ft^2 Canopy	100 ft^2 Canopy	50 ft^2 Canopy
1 Inch per Week	Low Water Using 0.3	38	19	10
	Med. Water Using 0.5	62	31	16
	High Water Using 0.8	100	50	25
2 Inches per Week	Low Water Using 0.3	76	38	19
	Med. Water Using 0.5	124	62	31
	High Water Using 0.8	200	100	50
3 Inches per Week	Low Water Using 0.3	114	57	28
	Med. Water Using 0.5	186	93	47
	High Water Using 0.8	300	150	75

Gallons per week calculation for this chart was determined with the following formula:
Gal/Week = ET x Plant Factor x Area x 0.62 (Conversion factor). This formula does not account for irrigation efficiency. If the irrigation system does not distribute water evenly, extra water will need to be applied.

Example: 4 bedroom home with a washer will produce 1,120 gallons per week (7days x 160GPD). If ET = 2 inches per week, then the 1,120 gallons of gray water a homeowner could irrigate:

8 small fruit trees:	8 x 50 = 400 gallons (high water using, 50 ft canopy)
8 medium shade trees:	8 x 62 = 496 gallons (med. water using, 100 ft canopy)
7 large shrubs:	7 x 31 = 217 gallons (med. water using, 50 ft canopy)
Total water use per week:	1,113 gallons per week

Other Requirements.

1. The Graywater Standards (UPC) require that all graywater piping be marked "Danger Unsafe Water."

2. Valves in the plumbing system must be readily accessible, and backwater valves must be installed on surge/holding tank drain connections to sanitary drains or sewer piping. Ball valves are recommended to be used in the system. Finally all piping must be downstream of a waterseal type trap(s) if no such trap exists, an approved vented running trap shall be installed upstream of the connection to protect the building from possible waste or sewer gasses.

3. Surge tank must be vented and have a locking gasketed lid. If the surge tank is within the structure, then the venting must meet the requirements of the Uniform Plumbing Code. Outside surge tanks shall be vented with a 180° bend and screened. A minimum capacity of 50 gallons is required. The surge tank must be placed on a 3-inch concrete slab or on dry level compacted soil and the lid labeled "Graywater Irrigation System, Danger-Unsafe Water." Surge tanks shall be constructed of solid durable materials, not subject to excessive corrosion or decay, and shall be watertight. The tank drain and overflow gravity drain must be permanently connected to the septic tank or sewer line. The drain and overflow drain shall not be less in size than the inlet pipe.

4. Filters with a minimum flow capacity of 25 gallons per minute are required.

5. Pumps are usually required to lift the graywater from the surge tank to the irrigation system (See pressure Distribution System Section). Alternatively if all of the landscape plants are below the building drain lines then the graywater irrigation system could use gravity to distribute the graywater.

6. Irrigation system can be either a mini-leachfield or a subsurface drip irrigation system. Mini-leachfield designs follow the rules and are required to use geotextile for the drainrock soil barrier.

Notes:

1. The following plants are tolerant of sodium and chloride ions or have been reported to do well under graywater irrigation:

Crape Myrtle	Redwoods	Star Jasmine	Holly	Deodar Cedar
Bermuda Grass	Honeysuckle	Oaks	Cottonwood	Arizona Cypress
Oleander	Bougainvillea	Rose	Rosemary	Agapanthus
Italian Stone Pine	Purple Hopseed Bush	Olive	Juniper	Sweet Clover
Strawberry Clover	Evergreen Shrubs	Pfitzer Bush		Carpet Grass

2. Several different types of media can be used in graywater filtration. These include: nylon or cloth filters, sand filters, and rack or grate filters.

3. Mini-Leachfield Design Criteria:

Mini-Leachfield Design Criteria	Minimum	Maximum
Number of drain lines per irrigation zone	1	---
Length of each perforated line	---	100 ft
Bottom width of trench	6 inches	18 inches
Total depth of trench	12 inches	18 inches
Spacing of line, Center to Center	3 ft	4 ft
Depth of earth cover over lines	6 inches	12 inches
Depth of aggregate over pipe	2 inches	---
Depth of aggregate beneath pipe	2 inches	---
Grade on perforated pipe	Level	1 inch / 100 ft

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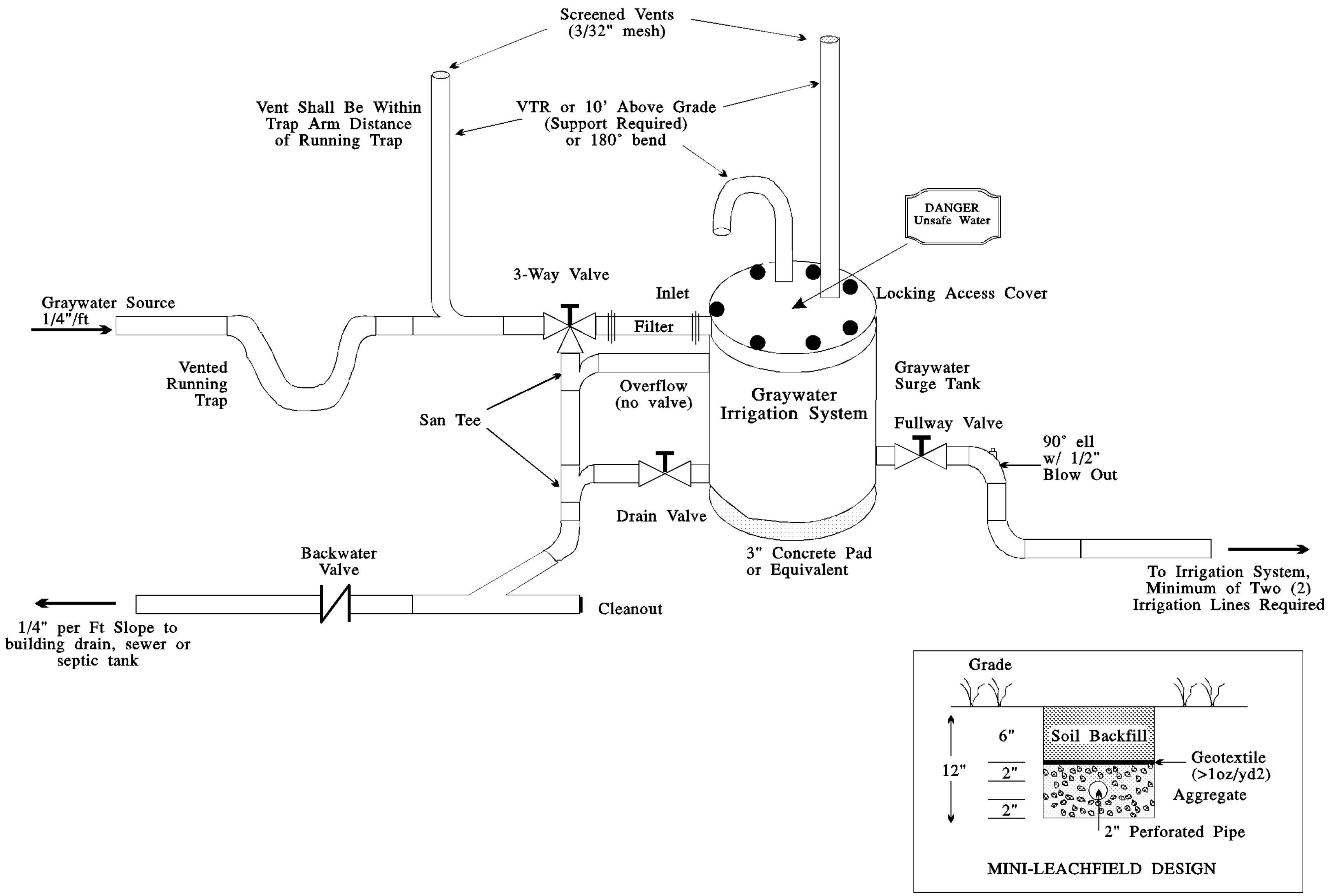
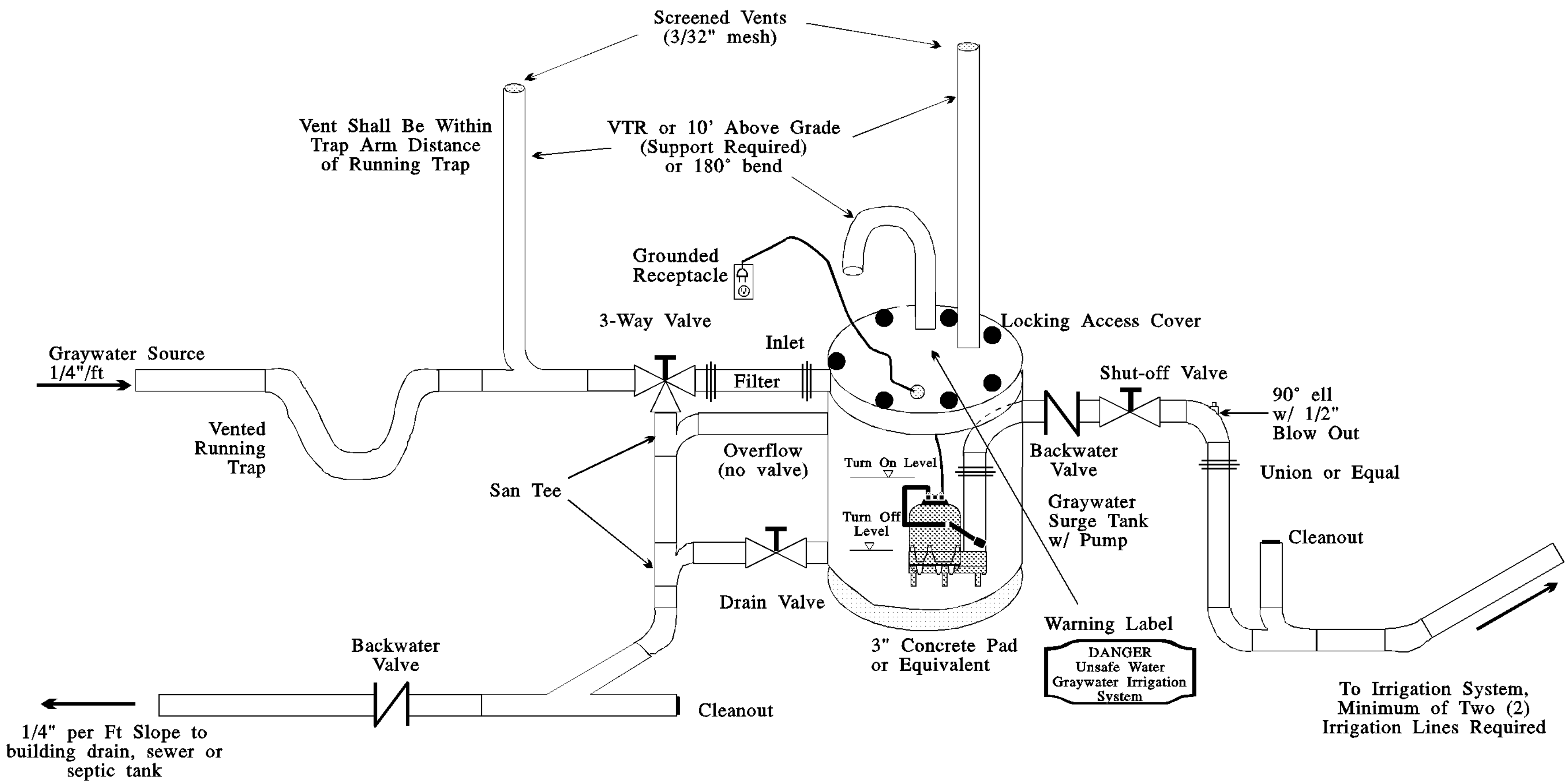
GRAYWATER SYSTEM (Single Tank - Gravity)



GRAYWATER SYSTEM (Single Tank - Pumped)



Appendix D.
Subsurface Flow Constructed Wetlands

Subsurface Flow Constructed Wetlands

Prepared by:

Barry N. Burnell, REHS

Idaho Department of Environmental Quality
1410 North Hilton
Boise, ID 83706-1255
e-mail: bburnell@deq.state.id.us

March 31, 2003

DRAFT

Disclaimer

The intended use of the Subsurface Flow Constructed Wetland paper is to provide an experimental wetland design to be used in conjunction with the Experimental Systems Section of the Idaho DEQ Technical Guidance Manual for Individual Subsurface Sewage Disposal Systems (TGM). The suggested design criteria are provided to ensure that construction is consistent and that a standard monitoring and sampling protocol is used in order for the experimental system to be monitored using methods that will allow for comparison of results between locations.

Idaho DEQ makes no claims that the design presented in this paper will prove to be satisfactory in all locations of the state. The owner must hold the Department of Environmental Quality and Health District harmless from any liability arising for the use of an experimental system. All conditions for approval in the Experimental System section of the TGM must be met in order to construct a Subsurface Flow Constructed Wetland.

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Subsurface Flow Constructed Wetlands

Barry N. Burnell, REHS
State Technical Services Office
Idaho Department of Environmental Quality
1410 N. Hilton
Boise, Idaho 83706-1205
bburnell@deq.state.id.us

March 31, 2003

ABSTRACT

The use of constructed wetlands in the United States is reviewed and an experimental design and sampling methodology is presented. A table of constructed wetland vegetation is provided. The use of constructed wetlands in Idaho under the Onsite Wastewater Program is considered an experimental design and must meet all the conditions of approval as stated in the Idaho DEQ Technical Guidance Manual For Individual Subsurface Sewage Disposal (TGM).

Two design approaches are presented and compared to provide a basis analyzing treatment results from the experimental constructed wetlands. A monitoring protocol is presented for use in issuing experimental onsite wastewater permits and in order for data to be collected that is comparable. Data collection and analysis is critical to move the system design and performance information from experimental to an approved standard system.

INTRODUCTION

Constructed wetlands may take many forms. Most employ herbaceous plant species rather than trees or shrubs, making them more similar to a marsh in species composition. Constructed wetlands are generally divided into two categories: Free Water Surface (FWS) and Subsurface Flow. In Free Water Surface (FWS) constructed wetlands the majority of water flow is over the sediment and through the plants stems and leaves. In the Subsurface flow or vegetated submerged bed (SW) constructed wetlands are designed to conduct water through a bed of gravel and make contact with the plant roots. This paper will focus on subsurface constructed wetlands. A cross section of a vegetated submerged wetland is provided in Figure 1. The water level is below ground surface and the water flow is through the gravel bed. The roots of planted wetland species penetrate to the bottom of the bed providing a surface for microorganisms to live on and delivering oxygen to the water. Wetland plants commonly planted are reed, bulrush, and cattail (Water Pollution Control Federation. 1990.). The advantages of the vegetated submerged bed systems are greater cold tolerance, minimization of vector and odor problems, and better public health protection.

The objectives of this study are to determine the appropriateness of using subsurface flow constructed wetlands as a pretreatment methodology to reduce pollutant loading to ground water. A second objective would be to develop a low cost alternative systems design that would replace sand mounds, sand or gravel filters or extended treatment package systems. The advantages of a subsurface flow constructed wetland would be lower initial costs to property owners, reduced power usage during the life of the system and fewer mechanical parts to maintain.

The various land forms and climates in Idaho often preclude the use of one system over another. For example evapotranspiration (ET) systems are suitable for use in semi-arid desert sections of southern Idaho while an ET system is not feasible in the temperate wetter climates of north Idaho. In order to gather information suitable for the majority of the state, two representative sites will be selected that will account for the wide range in Idaho's climate.

Locations for the demonstration project will be selected based on agreements from the property owner for participation in the demonstration project. Applicants will be screened to select property owners with a 3 or 4 bedroom home and with year round occupancy. A property owner will be selected in Southern Idaho for a site that has low precipitation and high evaporation rates. The second site will be selected in a location with a low evaporation rate and higher precipitation to represent a more extreme weather site.

WETLAND BACKGROUND

Hydraulic Flow. A standard 1000-gallon concrete septic tank will be used to settle and separate the wastewater. The septic tank will be equipped with an effluent filter, which will screen the effluent of any solids that may clog the wetland media. The effluent is delivered by gravity to a sampling port for collection of the filtered septic tank effluent. The effluent will flow from the sampling port to the constructed wetland. Discharge to the influent side of the constructed wetland is through four-inch perforated pipe bedded in large diameter stone (Figure 2).

The effluent will travel horizontally on a slight gradient through the constructed wetland. The wetland characteristics are described in Table 1. Effluent is collected in a four-inch perforated pipe at the end of the wetland cell. Prefabricated PVC boots are used to penetrate the liner with the four-inch pipes. The outlet pipe is connected to the downstream sampling port.

Table 1. Subsurface Flow Wetland Characteristics.

Water Depth	12 -24 inches
Length to Width Ratio	1:1 up to 4:1
Number of cells	one or two
Media	Stone 3-4" for inlet and outlet area Gravel 1.5 to 3 inches for wetland Pea Gravel or bark mulch 3-4" for cover
Water Surface	1-3" Below pea gravel/mulch interface
Vegetation	See Table 2
Liner	30 mil PVC or equivalent
Slope (inlet to outlet)	0.1 to 1%

Water level in the wetland is controlled by a standpipe in the downstream sampling port. The sampling port discharges to a subsurface sewage distribution drainfield (see Figure 3). The standpipe/sampling port can be located in the wetland cell for cold weather protection. Dependant upon removal efficiencies for Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), Total Nitrogen, Total Phosphorus, and coliform bacteria, the potential outcomes of the wetland studies is that drainfields may be reduced in size and have reduced setbacks to ground and surface waters.

Vegetation. The presence of vegetation is critical for subsurface flow wetlands. Many different types of plants have been used in constructed wetlands. Table 2 is a list of the wetland vegetation used in various systems around the country. Bulrush (Scirpus sp) and Cattails (Typha sp) are the most common in North America. Reeds are typical wetland plants of constructed wetlands in Europe.

Wetland vegetation selected for the demonstration will be a diverse mixture of Cattails (Typha species), Hard-Stem Bulrush (Scirpus acutus), Rocky Mountain Iris (Iris sp.), Nebraska Sedge (Carex nebrascensis), Creeping Spikerush (Eleocharis palustris), Common Reed (Phragmites communis) and Arrowhead (Saggitaria latifolia). These plants are selected for their treatment capabilities and habitat value. Local plants that are adapted to the regional environment are preferred. Commercial nurseries are also capable of providing plant stock for the project. Transplanting of wetland plants is required to start the systems with good plant materials. This provides for a quickest most reliable approach to establishing wetland vegetation (Vassos, T.D. 1999).

Table 2. Constructed Wetland Vegetation.

Common Name	Scientific Name	Notes	Reference
Arrow Arums	Peltandra virginica		1, 2, 11
Arrowhead	Sagittaria latifolia		1, 2, 12, 16, 26
Broad-leaved Cattail*	Typha latifolia	Tolerates poor water quality Poor N and P Removal 10-30°C 0.30 m Root Depth	1, 2,7, 10, 11, 15, 16, 20, 21, 24, 26, 30
Pickerel Weed	Ponitederia lanceolota		1, 2, 26
Giant Reed	Phragmites australis	Noxious Growth	1, 2, 10, 15, 16
Common Reed*	Phragmites communis	Good oxygen transfer 12-23°C 0.60 m Root Depth	2, 7, 20, 21, 23, 24, 30
Elephant Ear	Colocasia esculenta	gulf coast	1, 2, 16, 24, 25
Canna Lilly	Canna flaccida	gulf coast	1, 2, 16, 26
Calla Lilly	Zantedeschia aethiopica	gulf coast	1, 2, 16, 25
Day Lily	Hemerocallis sp.		26
Ginger Lilly	Hedychium coronarium		1, 2
Water Iris	Iris pseudacorus		16, 25, 26
Blueflag	Iris sp.		2, 11, 12
Sweet Flag	Acorus sp.		11, 12, 16
Rush family	Junacaea	16-26°C	16, 20, 30
Salt Rush, Baltic Rush	Juncus Balticus		10
Bulrush*	Scirpus americanus	0.80 m root depth	1, 2, 11, 20, 21, 30
Soft-stem Bulrush	Scirpus validus	Municipal systems	2, 12, 15, 16, 26
Hard-stem Bulrush	Scirpus acutus		2
River Bulrush	Scirpus flaviatilis		10
Woolgrass	Scirpus cyperinus		12
Grass family	Gramineae		15, 16
Sedge Family	Cyperacaea (Carex spp.)		15, 30
Lake Sedge, Ripgut	Carex lacustris	14-32°C	10, 20
Watar Plantain			11
Cardinal Flower			11
Great Blue Lobelia			11

Table 2. Constructed Wetland Vegetation.

Common Name	Scientific Name	Notes	Reference
Swamp Milkweed			11
Sweet and Balzing Star Liatris			11
Ironweed			11
Maidencane	Panicum hemitomon		26

(*Cold tolerant species)

The major benefit of wetland plants is transfer of oxygen from the root zone to the wastewater. The physical presence in the wetland of plant stalks, roots, and rhizomes penetrates the support medium and transfers oxygen deeper into the medium than it would naturally occur by surface diffusion alone. Vegetated submerged bed constructed wetland systems that use bulrush and common reeds have good aeration potential due to their root development. The most commonly used species in vegetated submerged bed systems worldwide has been the common reed. Cattails are also widely used as a wetland plant, but have a shallow rooting depth (Water Pollution Control Federation. 1990).

<u>Cattails</u>
Cattails (Typha spp.) Are ubiquitous in distribution, hardy, capable of thriving under diverse environmental conditions, and easy to propagate and thus represent a good plant species for constructed wetlands. They are also capable of producing a large annual biomass and provide a potential for N and P removal, when harvesting is practiced. Cattail rhizomes planted at approximately 1 m (3.3 ft) intervals can produce a dense stand within three months (Kadlec, R. 1991).

<u>Bulrushes</u>
Rushes are members of the family Junacaea and are perennial, grasslike herbs that grow in clumps. Bulrushes (Scirpus spp.) are ubiquitous plants that grow in a diverse range of inland and coastal waters, brackish and salt marshes and wetlands. Bulrushes are capable of growing well in water that is 5 cm to 3 m deep (2''-10'). Desirable temperatures are 16-27?C (68-81?F). Bulrushes are found growing in a pH of 4-9 (Kadlec, R. 1991).

<u>Reeds</u>
Reeds (Phragmites communis) are tall annual grasses with an extensive perennial rhizome. Reeds have been used in Europe in the root-zone method and are the most widespread emergent aquatic plant. Systems utilizing reeds may be more effective in the transfer of oxygen because the rhizomes penetrate deeper into the wastewater than cattails (Kadlec, R. 1991).

<u>Pathogens</u>
Natural systems can deactivate and remove bacteria and viruses. Kadlec (1991) reports that human enteric bacteria can be reduced by 99% if the hydraulic residence time is 10 days. Viruses can also be reduced by 99.99% in 10 days. Reduction is based on sorption to sediments and soil particles, and predation by other organisms (Kadlec, R. 1991).

SYSTEM DESIGN

Constructed wetlands have certain properties in common: inlet structures, retention time, vegetation, and outlet structures. Natural wetlands have dense plant biomass which promotes filtration of the water moving through the wetland, nutrient uptake, and provides oxygen into the soil via the rhizomes. These properties are favorable for wastewater treatment and constructed wetlands are designed to incorporate these properties.

For submerged flow constructed wetland systems the bed width is determined by hydraulic capacity and bed length by pollutant removal requirements and residence time. Submerged bed wetlands may have length to width ratios between 1:1 and 4:1 depending upon the treatment goals and site conditions. Most of the removal takes place in the vicinity of the discharge area, with decreasing total assimilation per incremental distance from the discharge point. For systems required to achieve lower Biochemical Oxygen Demand (BOD_5 <30 mg/l) or Total Nitrogen (TN) discharge standards, higher length to width ratios are necessary to remove the incremental BOD_5 or TN as background levels are approached. Removal efficiencies for BOD_5 and TN are greatly reduced at low input concentrations (Kadlec, R. 1991).

Method 1

Depth, Volume and Residence Time. The depth chosen has an important influence on the effective wetland volume and, consequently, the hydraulic residence time (HRT). Depth, volume, and HRT are interrelated and can be expressed as:

$$HRT = (D)(A_w)v / Q$$

Where:

HRT	=	Hydraulic Residence Time, Days
D	=	Water Depth, meters
v	=	Void Fraction
A_w	=	Wetland Area, m² and
Q	=	Flow rate, m^3/d

For a northern constructed wetland a HRT equal to 7 days was found to be optimal (Kadlec, R. 1991). The critical HRT for achieving TSS removal efficiencies above 70% appears to be about 5 days. Total nitrogen removal efficiency is highly dependant on HRT and decreases significantly at Design HRTs of less than 5 days (Kadlec, R. 1991). The typical maximum total phosphorus removal potential for unharvested, natural wetlands is about 0.3 to 0.4 kg/ha/d (Kadlec, R. 1991).

If we set HRT at 7 days, the wetland cell water depth at 0.45 m (1.5 ft), the void fraction for gravel at 0.35, and the wastewater flow at 1.1356 m^3/day (300 GPD), we can solve for wetland area A_w. The surface area of the wetland should be designed for a minimum area of 49.7 m² or 535 ft². Deeper wetland cell designs with water depth levels at 0.6 m (2 ft) would result in a surface area design of 37.9 m² or 408 ft².

For submerged flow wetland systems, the cross-sectional area is expressed as:

$A_c = Q/(K_sS)$ or $DW = Q/(K_sS)$

Where:

A_c = Depth (D) x Width (W), cross sectional area of bed, m²
Q = Flow rate, m^3/d (1.1356 m^3/d = 300 GPD)
K_s = hydraulic conductivity of the media, m/d (use 259 m/d or 850 ft/d)
S = Bed Slope, drop (m)/over run (m) (use 0.001 to 0.01)
W = Bed Width, m (1m = 3.28 ft)
D = Bed Depth, m

Normal design bed depth for submerged flow wetland systems is between 30 and 60 cm. Bed width (W) can be calculated based on A_c determined from the above equation, $W = Q/ (K_sSD)$. If the wastewater flow Q is 1.1356 m^3/d (300 GPD), the hydraulic conductivity is 259 m/d (850 ft/d), the bed slope is .25%, and the depth is 0.6 m (2 ft); then the width of the wetland cell should be designed at 2.9 meters or 9.5 ft. A shallower cell of 0.45 m (1.5 ft) results in a wider wetland cell design of 3.9 m or 12.7 ft. Narrower is not always better, because the front inlet manifold should be designed to spread the effluent out throughout the wetland cell in order to avoid solids accumulation at the inlet manifold and surfacing of partially treated effluent.

A wetland cell designed to accept 300 GPD flow and with a water depth of 0.6 m (2 ft) results in a wetland cell that is 2.9 m wide by 13 meters long for a area of 37.9 m². Check the length to width ratio to be sure design is longer than wide and within range of 1:1 to 4:1. 13 m divided by 2.9 m = 4.5, the length to width ratio is acceptable. The wetland cell would be 2.9 m or 9.5 feet wide by 13 m or 42.6 feet long. The depth is 0.6 m or 2 feet deep with gravel/mulch top layer and a slope of 0.25%. The slope results in an added depth of 1.28 inches (3.25 cm) over the 42.6 feet.

Method Two
Determine the surface square footage of the constructed wetland.
Identify the projected wastewater flow from Section 007 of the Rules for Individual/subsurface Sewage Treatment and Distribution. Determine the constructed wetland surface area based on the wastewater flow and a surface hydraulic loading criteria of 1.5 square feet of total surface area per gallon per day (ft²/GPD). The hydraulic loading criteria is a margin of safety for design purposes.

Example: Homes with a wastewater flow of 300 GPD will have a constructed wetland surface area of 300 GPD times 1.5 ft²/GPD surface hydraulic loading criteria or 450 ft². Wetland Surface Area is 450 ft².

Determine the cross sectional area (Ac) based on wastewater flow (Q). Wastewater flow is expressed in ft^3/day. Take the wastewater flow in GPD and divide by 7.48 gal/ft3 times the margin of safety of 1.5. Use Darcy' law and a low hydraulic gradient or wetland bed slope (S = up to 1%) and a hydraulic conductivity (Ks) of 850 ft/day.
Darcy' Law:

$Q = (Ac)(Ks)(S)$

Where:
Ks = substrate hydraulic conductivity (850 ft/day)
S = hydraulic gradient or wetland bed slope up to 1%
Q = flow rate in ft^3/day, and
Ac = the cross sectional area of the wetland cell

For example:
Using the 300 GPD home example we have 40 ft^3/day flow times the margin of safety, 1.5, and we get a design flow of 60 ft^3/day (40 times 1.5 = 60); the wetland bed slope of 0.25% S = 0.0025; and a hydraulic conductivity Ks of 850 ft/day.

The cross sectional area is:
$60\ ft^3/day = Ac\ (850ft/day)(0.0025)$ or $Ac = (60\ ft^3/day)/(850ft/day)(0.0025) = 28.2\ ft^2$
$Ac = 28.2\ ft^2$

<u>Determine constructed wetland bed length and width</u>. First determine wetland cell width from the cross sectional area, Ac divided by the wetland cell liquid depth. $WW = Ac/D$
Where:
WW = wetland width, ft
Ac = cross sectional area (ft^2), and
D = depth, ft

Using a two foot deep wetland cell (D) and use the cross sectional area of 28.2 ft^2. The wetland cell width is 14.1 feet.

Next calculate the wetland cell length. Knowing the surface area as calculated previously and dividing it by the width will determine the wetland cell length. The constructed wetland surface area was 450 ft^2 divided by the width 14.1 ft equals the constructed wetland bed length of 31.9 ft.

Check design to verify length to width ratios are met. Length is 31.9 ft to a width of 14.1 ft for a ratio of 2.3:1. This is within the length to width design parameters of 1:1 to 4:1.

The wetland cell is 14.1 feet wide and 31.9 feet long with a cross section depth at the front end of 2 feet. Because the cell slopes in the example at 0.25%, the inlet side of the wetland cell is 2 feet deep and the discharge end of the wetland cell will be 2 ft + the slope times the length. 2 ft + 0.0025 x 31.9ft = 2.08 ft or 25 inches.

Each site will need to be evaluated for suitability and a constructed wetland system design developed based on wastewater flow, topography, and landscaping.

Design Method Comparison
The two methods rely on slightly different approaches and some similarities. Both use Darcy's law for determining wetland size. Method one focuses on hydraulic residence time to determine treatment goals and size of the wetland surface area. Method two uses a margin of safety and

flow to estimate wetland surface area. A comparison of the both design methods and method 2 without a margin of safety are depicted in Table 3.

Table 3. Wetland Design Comparison.

Design Feature	**Method 1-HRT**	**Method 2-MOS**	**Method w/o MOS**
Length	42.6 ft (13 m)	39.1 ft (11.9 m)	31.9 ft (9.7 m)
Width	9.5 ft (2.9 m)	14.1 ft (4.3 m)	9.4 ft (2.9 m)
Surface Area	408 ft^2 (37.9 m^2)	450 ft^2 (41.8 m^2)	300 ft^2 (27.9 m^2)
Cross Section Area	19 ft^2 (1.8)	28.2 ft^2 (2.6 m^2)	18.8 ft^2 (1.8 m^2)
Depth 2-3 feet (0.6-0.9 m)	2 ft (0.6m)	2 ft (0.6m)	2 ft (0.6m)
Flow 300 GPD (1.1356 m^3/d)	300 GPD (40 ft ft^3/day)	300 GPD	300 GPD
Slope 0-1% (0.25%)	0.25%	0.25%	0.25%
Hydraulic Conductivity (850 ft/d or 259 m/day)	850 ft/d (259 m/d)	850 ft/d (259 m/d)	850 ft/d (259 m/d)

SYSTEM MONITORING

Each constructed wetland demonstration site will have samples collected after the wetland vegetation has been established and is showing signs of active growth. This could be between three (3) and sixth (6) months after transplanting wetland plants depending on season of construction and vegetation planting.

Samples will be collected quarterly for a year from both newly constructed systems and from the existing experimental system in Twin Falls. Samples will be analyzed for the following constituents:

Table 4. Wetland Sampling Plan

	BOD	TSS	TKN	NO3+NO2 (N)	T.P	Coliform Density	DO	pH, temp, conductivity
1 QTR	Lab	Lab	Lab	Lab	Lab	Lab	Field	Field
2 QTR	Lab	Lab	Lab	Lab	Lab	Lab	Field	Field
3 QTR	Lab	Lab	Lab	Lab	Lab	Lab	Field	Field
4 QTR	Lab	Lab	Lab	Lab	Lab	Lab	Field	Field

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MATERIALS LIST

Request for Proposal List of Materials:

1000 gallon concrete septic tank
30 feet of Schedule 40 pipe from house to tank
10 feet of ASTM D-3034 pipe from tank to sampling port
Sampling port, ex. Tuff tight plastic box or concrete D box with lid exposed at ground surface.
75 feet of ASTM D-3034 pipe from sampling port to wetland.
10 feet of perforated drainpipe, inlet
Inlet stone 3-4" washed rounded rock. 2'x14'x2'=56ft3 =2.0 $yard^3$
Wetland media 1.5 – 3.0" washed rounded rock. 2'x14'x35'=980ft3 =36.3 $yard^3$
Outlet stone 3-4" washed rounded rock. 2'x14'x2'=56ft3 =2.0 $yard^3$
10 feet of perforated drainpipe, outlet
Wetland liner 30 mil PVC 20' by 45' (2.5' deep, 14 feet wide, by 39 feet long) 6 inch overlap @ ends
Two, four inch pipe boot sleeves and glue for pipe/PVC weld
Bedding sand for liner, 5 $yard^3$
Mulch or Pea Gravel 0.25' deep by 14' by 39' or 136.5ft^3 or 5 $yard^3$
10 feet of ASTM D-3034 pipe from tank to sampling port
Sampling port, ex. Tuff tight plastic box or concrete D box with lid exposed at ground surface.
4" elbow and pipe cut to maintain 1 foot of water in wetland placed in second sampling port.
20 feet of ASTM D-3034 pipe from sampling port to drainfield.
Drainfield suitable for a three or four bedroom home, sized based on receiving soils, see permit.
Extra pipe to be placed in wetland bed vertically on a one foot grid pattern

Installer qualifications:
Must be licensed complex installer
Must have experience with installation and bedding PVC liners
Must be able to use laser level and excavate wetland bed to 0.25% slope

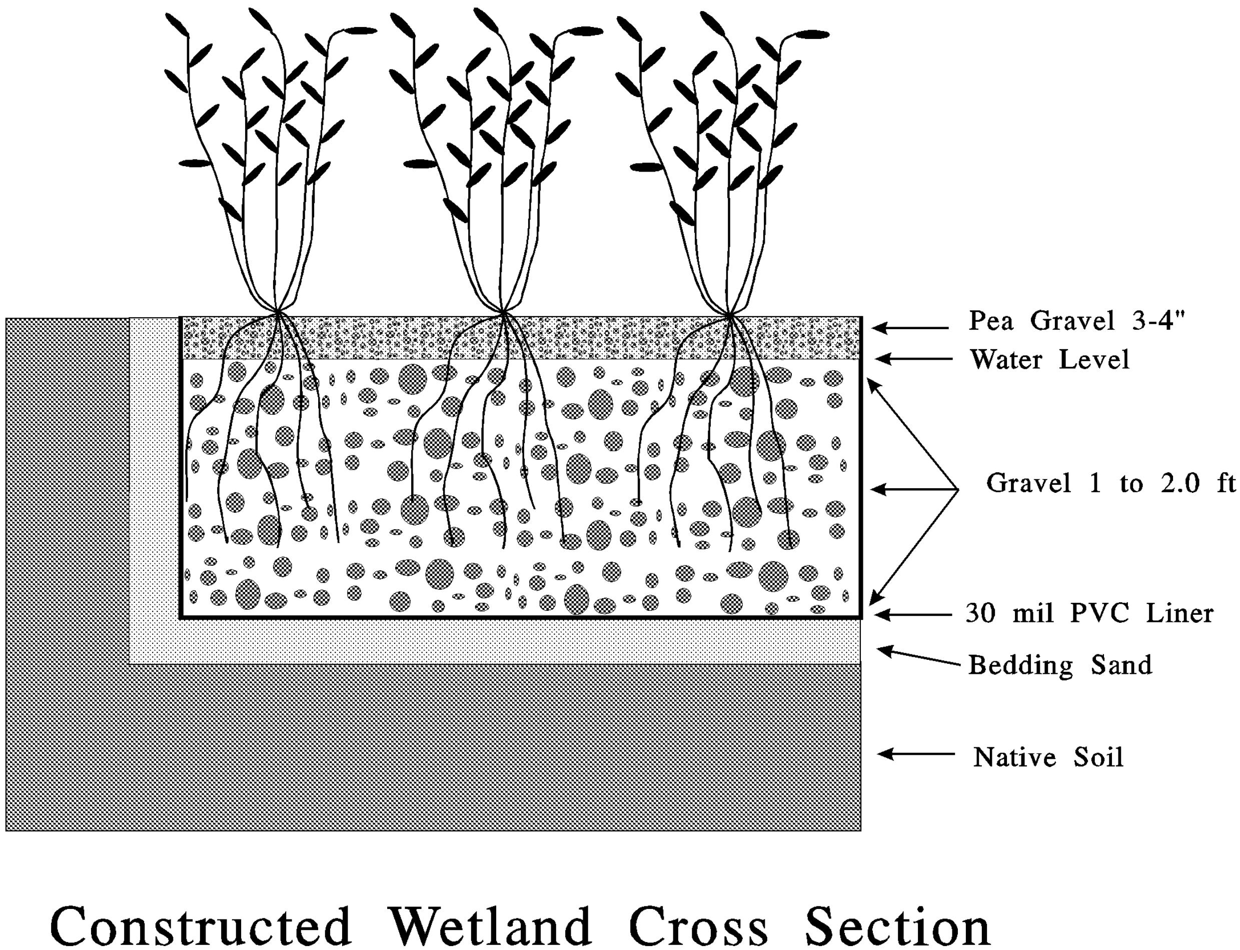


Figure 1. Cross Section View of Subsurface Flow Constructed Wetland

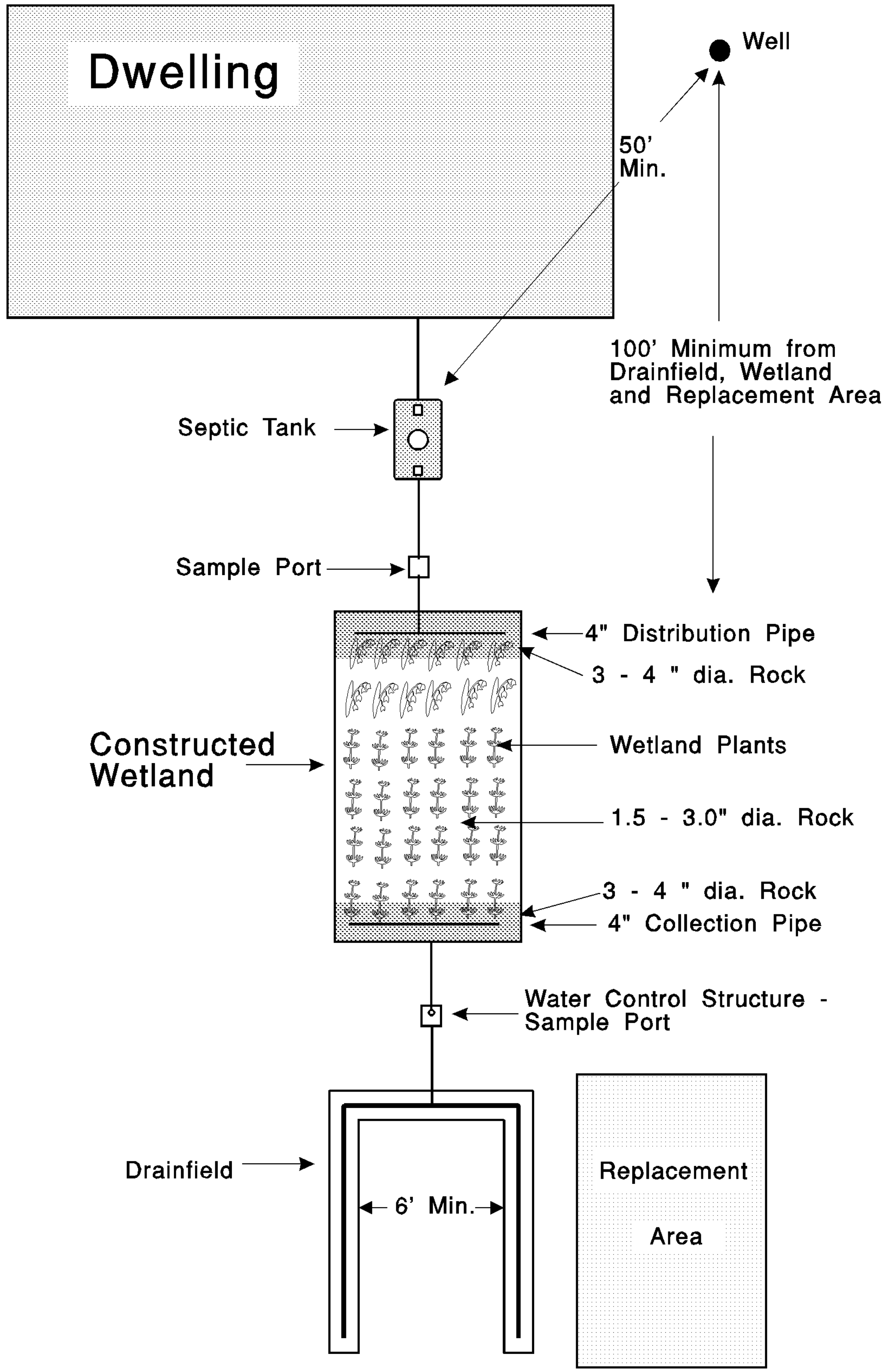


Figure 2. Plan View of Subsurface Flow Constructed Wetland.

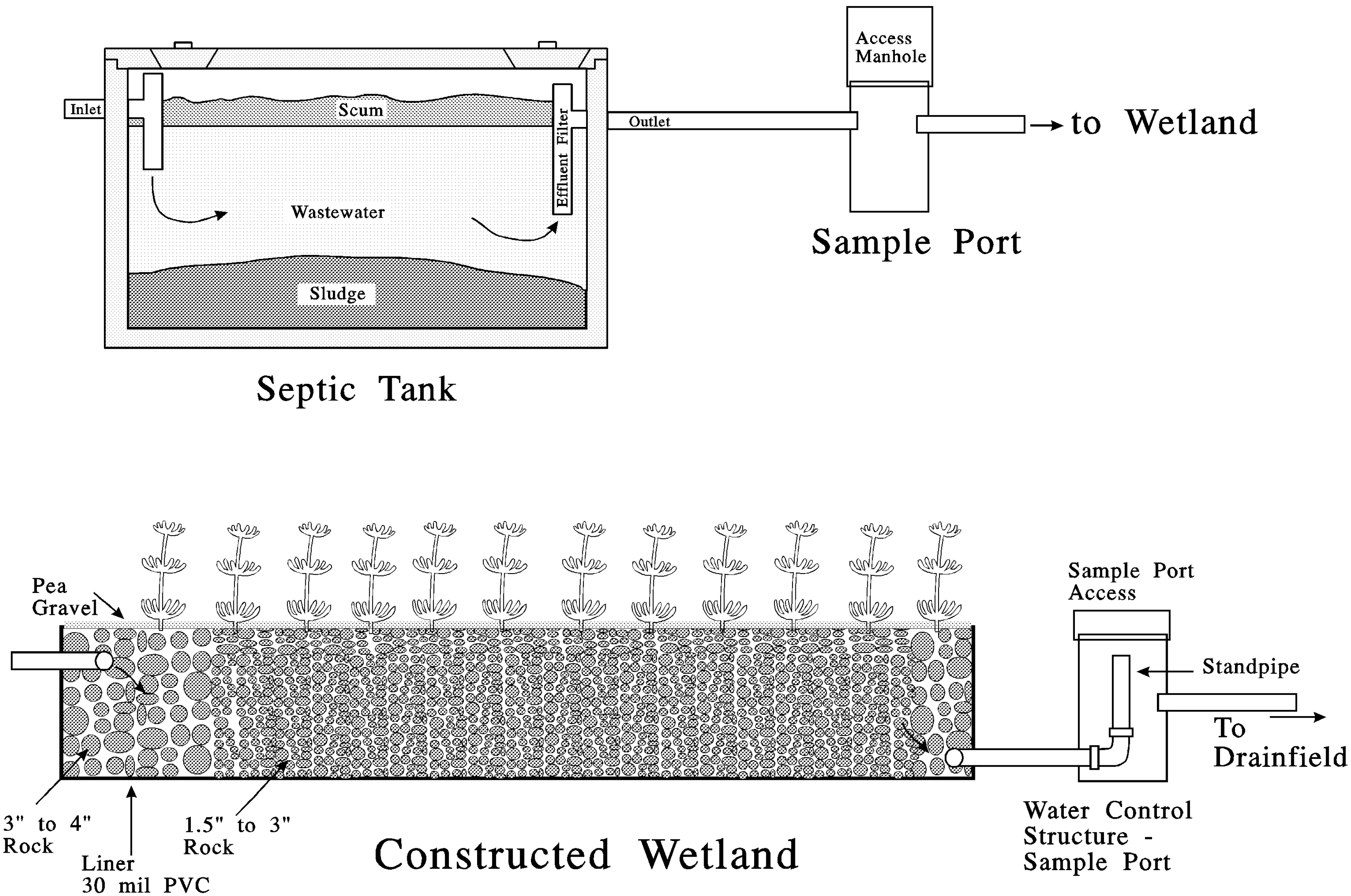


Figure 3. Constructed Wetland Components Cross Section View.

Appendix E.
Pressure Distribution System

PRESSURE DISTRIBUTION SYSTEM

Description. A low pressure system of small diameter perforated plastic pipe laterals, manifold, pressure transport line, dosing chamber and a pump or siphon.

Conditions for Approval.

1. The pressure distribution system is to be used whenever it is desirable to:
   a. Maintain a uniform application rate throughout the drainfield.
   b. Treat and dispose of effluent in the uppermost levels of the soil profile.
   c. Aid in mitigating the potential contamination of groundwater in areas of excessive permeability.
   d. Improve the performance and increase the life span of a drainfield.

2. Pressure distribution may be used in sand mounds, sand filters, sand-filled trenches and standard trenches in aquifer-sensitive areas or in large drainfields. Geotextile filter fabrics are required to be used for cover over pressure distribution systems.

3. These guidelines provide for a simple strategy of design to assist the non-engineer. They are not intended to supplant or limit engineering design or other low pressure systems. The guidance should not be used where laterals are at different elevations (elevation differences greater than 6") or for systems with daily flows over 2,500 gallons. Plans for systems with designs different than those provided herein shall be reviewed by the Division of Environmental Quality. The following guide is recommended for pressure system design outside of these guidelines:

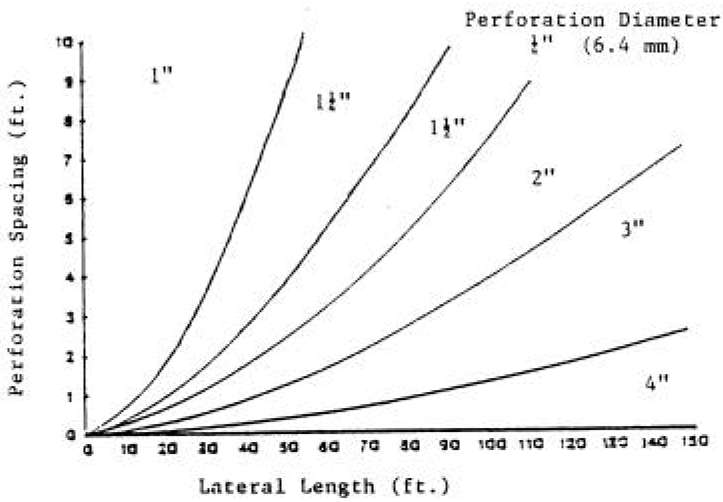
   Otis, R.J. 1981. Design of Pressure Distribution Networks for Septic-Tank Absorption Systems. Small Scale Waste Management Project Publication #9.6. University of Wisconsin, Madison, WI.

Design.

1. Laterals
   a. The lateral length should be shorter than the trench length by at least 6" but not more than one-half the orifice spacing.
   b. Laterals in trenches should be placed equidistant from each side.
   c. The lateral spacing in beds is typically 3 to 6 feet. The outside laterals should be placed at one-half the selected lateral spacing from the bed's edge.
   d. A preliminary estimate of orifice spacing should be made. Normally, the first estimate will be one-half the lateral spacing. For most installations the spacing will be between 18" and 36".
   e. The orifice diameter should be ?" (0.25"). A residual head of 2.5 feet is used for calculating flows and pump size. The flow through each orifice at that head will be 1.17 gallons per minute. Testing of the residual head shall be made on each lateral for terraced systems. Testing may be accomplished by placing the last orifice on a lateral in the up position and plugging the orifice with the lateral end cap or placing a screw in the orifice.

PRESSURE DISTRIBUTION SYSTEM (Cont'd)

f. Determine the lateral diameter from the following figure: (if a smaller diameter orifice is used, flow will change and the following table cannot be used).



g. The laterals should not exceed the lengths below for the pipe anticipated to be used.

Lateral Diameter, Inches	Orifice Spacing, Feet	Schedule 40	Class 200	Class 160	Class 125
1.0	1.5	16.5	21	21	-
1.0	2.0	20	24	24	-
1.0	2.5	22.5	27.5	27.5	-
1.0	3.0	27	33	33	-
1.25	1.5	27	30	31.5	31.5
1.25	2.0	32	36	38	38
1.25	2.5	37.5	42.5	45	45
1.25	3.0	42	48	48	51
1.5	1.5	34.5	39	39	40.5
1.5	2.0	42	46	48	50
1.5	2.5	47.5	52.5	55	57.5
1.5	3.0	54	60	63	63
2.0	1.5	52.5	55.5	58.5	60
2.0	2.0	64	68	70	72
2.0	2.5	72.5	77.5	80	82.5
2.0	3.0	81	87	90	93

PRESSURE DISTRIBUTION SYSTEM (Cont'd)

h. Calculate the lateral and total discharge rates:

Lateral Discharge Rate, gpm = 1.17 x number of orifices
Total Discharge Rate, gpm = Lateral Rate x number of laterals

i. Individual ball valves shall be installed on each lateral to balance residual head on terraced systems.

2. Manifold: Determine the manifold size from the following Table:

Lateral Discharge Rate (g.p.m.)	Manifold Diameter = 1?"	Manifold Diameter = 1?"	Manifold Diameter = 2"	Manifold Diameter = 3"	Manifold Diameter = 4"
Manifold	Lateral Spacing	Lateral Spacing	Lateral Spacing	Lateral Spacing	Lateral Spacing
End / Central	2 4 6 8 10	2 4 6 8 10	2 4 6 8 10	2 4 6 8 10	2 4 6 8 10
10 / 5	4 8 6 8 10	10 8 12 16 20	12 16 24 24 30	26 40 48 56 70	42 64 84 96 110
20 / 10	4 4 6	4 4 6 8 10	6 8 12 16 20	16 24 30 32 40	26 40 54 64 70
30 / 15	2	2 4 6	4 8 6 8 10	12 16 24 24 30	20 28 36 48 50
40 / 20			4 4 6 8 10	10 12 18 16 20	16 24 30 32 40
50 / 25			2 4 6 8	8 12 12 16 20	14 20 24 32 40
60 / 30			2 4	6 8 12 16 20	12 16 24 24 30
70 / 35			2 4	6 8 12 8 10	10 16 18 24 30
80 / 40			2	6 8 6 8 10	10 12 18 16 20
90 / 45			2	4 8 6 8 10	8 12 18 16 20
100 / 50			2	4 4 6 8 10	8 12 12 16 20
110 / 55				4 4 6 8 10	8 12 12 16 20
120 / 60				4 4 6 8 10	6 8 12 16 10
130 / 65				4 4 6 8 10	6 8 12 16 10
140 / 70				2 4 6 8	6 8 12 8 10
150 / 75				2 4 6	6 8 12 8 10
160 / 80				2 4 6	6 8 6 8 10
170 / 85				2 4 6	4 8 6 8 10
180 / 90				2 4	4 8 6 8 10
190 / 95				2 4	4 8 6 8 10
200 / 100				2 4	4 4 6 8 10

Example A: Central Manifold
Lateral Q = 40 gpm
Lateral Spacing = 6'
Manifold Length = 18'
Manifold Diameter = 4"

Example B: Terminal Manifold
Lateral Q = 30 gpm
Lateral Spacing = 6'
Manifold Length = 24'
Manifold Diameter = 3"

PRESSURE DISTRIBUTION SYSTEM (Cont'd)

3. Transport (Pressure) Line: Determine the diameter of the transport line from the following table. (The table is specifically for ABS schedule 40 pipe with a Hazen-Williams Coefficient of 150).

Friction Loss in feet per one hundred feet
Pipe Diameter, in inches

low, GPM	1"	1?"	1?"	2"	3"	4"
5	1.52	0.39	0.18			
6	2.14	0.55	0.25	0.07		
7	2.89	0.76	0.36	0.10		
8	3.63	0.97	0.46	0.14		
9	4.57	1.21	0.58	0.17		
10	5.50	1.46	0.70	0.21		
11		1.77	0.84	0.25		
12		2.09	1.01	0.30		
13		2.42	1.17	0.35		
14		2.74	1.33	0.39		
15		3.06	1.45	0.44	0.07	
16		3.49	1.65	0.50	0.08	
17		3.93	1.86	0.56	0.09	
18		4.37	2.07	0.62	0.10	
19		4.81	2.28	0.68	0.11	
20		5.23	2.46	0.74	0.12	
25			3.75	1.10	0.16	
30			5.22	1.54	0.23	
35				2.05	0.30	0.07
40				2.62	0.39	0.09
45				3.27	0.48	0.12
50				3.98	0.58	0.16
60					0.81	0.21
70					1.08	0.28
80					1.38	0.37
90					1.73	0.46
100					2.09	0.55
150						1.17

Example: The transport line will be 50" long and flow is calculated at 20 gpm. The headloss for 100' of 1 1/2" diameter pipe is 2.46'. For 50' it would be 1.23'.

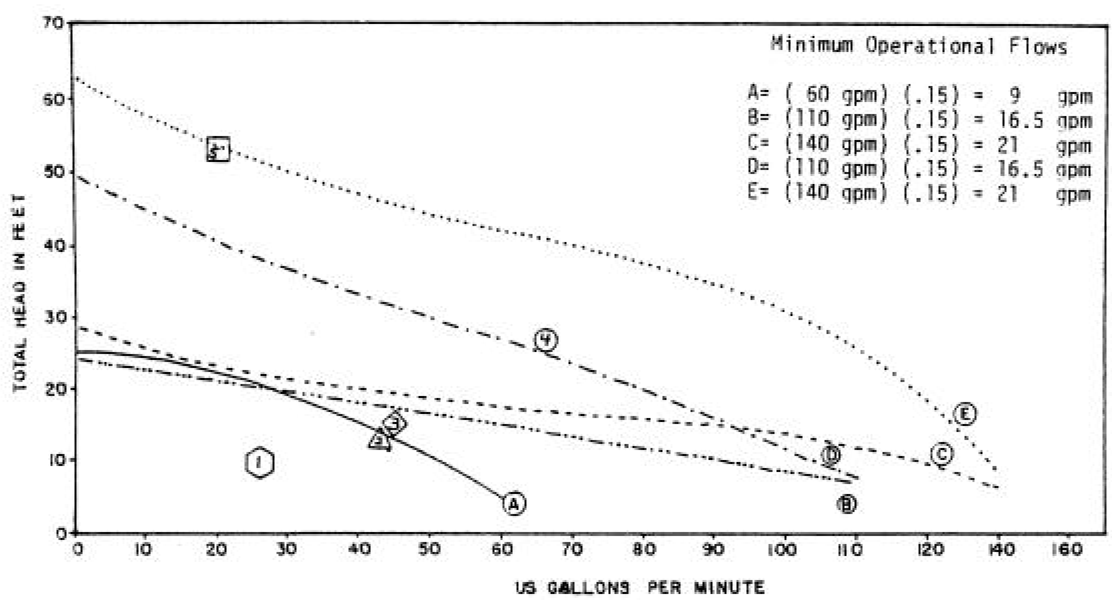
PRESSURE DISTRIBUTION SYSTEM (Cont'd)

4. Calculate the total head:

Total Head = E + T + R

Where: E = elevation difference between the pump and the manifold.
T = transport pressure line head.
R = residual head (2.5 feet).

5. Pump:
   a. Pump selection is a critical part of the system design package. It is based on the discharge rate and pumping head required for the system. Using the pump head-discharge rate curves supplied by the manufacturer, select a pump at the required head.
   b. To help maximize pump efficiency, pump selection should also address maximum usable head. Select pumps where the operating point will be greater than 15 percent of the maximum pump rate (maximum gpm rating). For example, a pump with a maximum capacity of 80 gpm should only be used if the operational requirement is greater than 80 gpm x 0.15 or 12 gpm.
   c. The preceding will help illustrate proper pump selection. Five pump curves are shown in the following example. In the upper right corner of the graph are the calculations showing the minimum operational flows based on the 15% pump curve efficiency requirement. In the table several system requirements are shown with the pumps ultimately selected.



System	GPM	TDH	Pump Selected	Comments
1	26	9'	A, B, or C	All pumps will work, but because of price and serviceability pump A, B or C were Selected.
2	43	13'	A, B, or C	Price and Serviceability
3	45	15'	B, or C	Pump A not adequate
4	67	26'	E	Pump D might be adequate. Check the operation point.
5	20	53'	N/A	20 GPM is less than 15 % of the maximum flow for pump E.

c. Other pump considerations:

- Pump should be specified for effluent.

- Pump should transfer solids as large as orifice diameter.

- Pump should be serviceable from ground level without the need to enter the pump chamber. PVC unions are available which assist in the easy removal of pumps.

- Pumps and electrical connections shall conform to the requirements of the Division of Building Safety, Electrical Bureau. Pumps must be kept submerged and all connections made outside the chamber in an explosion proof box <u>for multiple residential and commercial installations. For individual residential systems the electrical connections may be made in a weatherproof box. Both systems require the use of a seal off. See figures and page 58-59 for details.</u>

- Impellers shall be cast iron, bronze, or other corrosion-resistant material. Regardless of the material, the impeller may freeze if the pump remains inactive for several months.

- If for any reason a check valve is used, a bleeder hole should be installed so the volute is kept filled with effluent. Some pumps may run backwards if the impeller is in air.

PRESSURE DISTRIBUTION SYSTEM (Cont'd)

6. Dosage.

   a. Determine the dose volume by the following sets of design criteria:

      1) Soil Type:

         Determine the dose volume by dividing the average daily flow, in gpm, by the following recommended dosing frequency:

Soil Texture at Drainrock Interface	Doses per Day
Medium and fine sand	4
Loamy sand, sandy loam	1-2
Loam and finer soils	1

      2) Dose/Volume Ratio:

a) The daily dose volume ratio should be at least 7 times the volume of the manifold and lateral piping which drains between doses plus one time the interior volume of the transport line. If the dose is too small, then the pipe network will not become fully pressurized or may not be pressurized for a significant portion of the total dosing cycle.

b) It may be necessary to modify the piping network configuration to reduce the pipe volume or space which drains between doses.

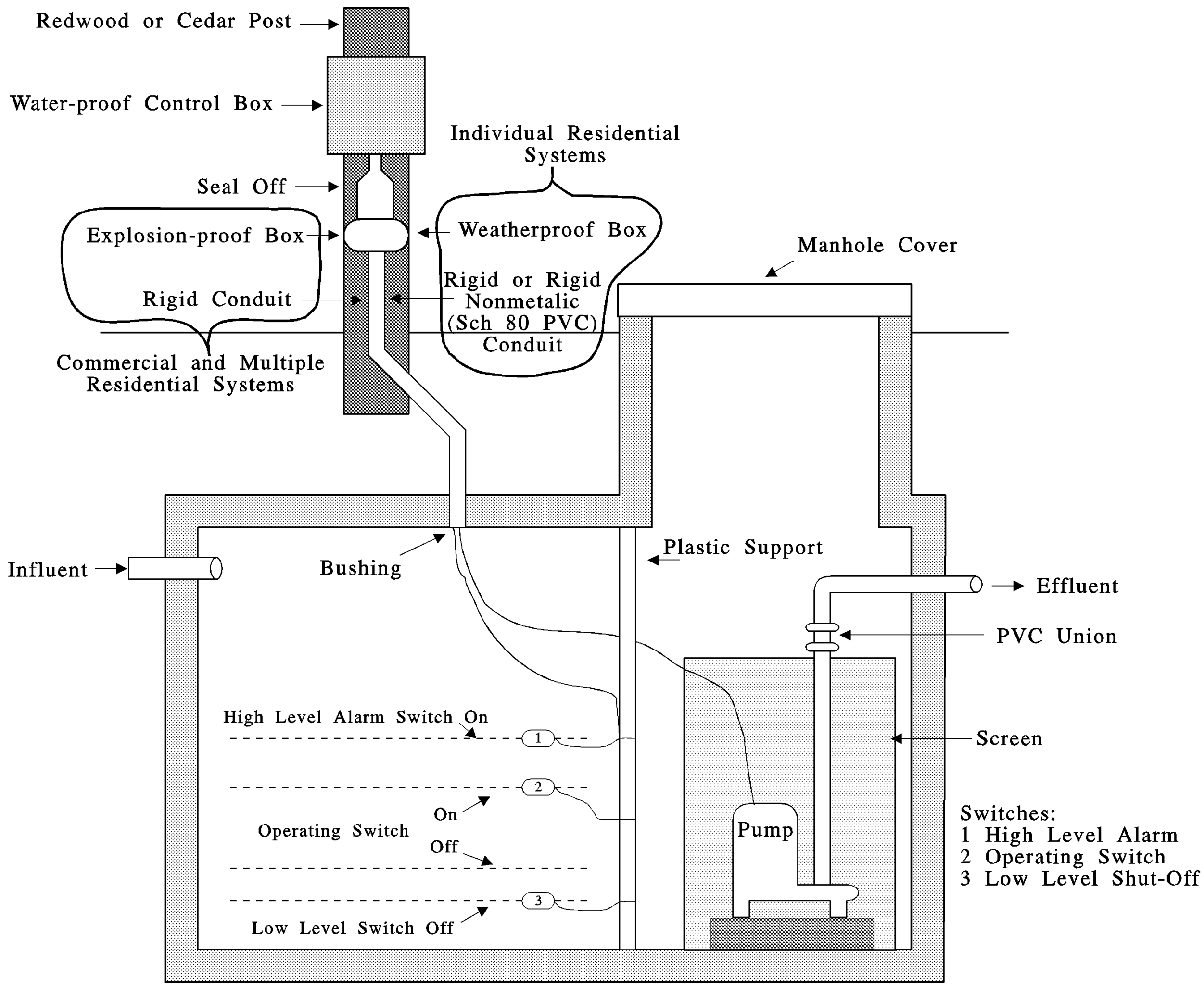
c) Use the following table to calculate distribution line, manifold, and transport line volumes. Calculate only pipe volumes that drain between doses.

Volume (Gal/ft of Length)

Diameter (Inches)	Schedule 40	Class 200	Class 160	Class 125
1	0.045	0.058	0.058	----
1?	0.078	0.092	0.096	0.098
1?	0.105	0.120	0.125	0.130
2	0.175	0.189	0.196	0.204
3	0.385	0.417	0.417	0.435
4	0.667	0.667	0.714	0.714
6	1.429	1.429	1.429	1.667

PRESSURE DISTRIBUTION SYSTEMS (Cont'd)

7. Dosing Chamber:



a. The dosing chamber must be watertight, with all joints sealed. Precautions must be made in high-groundwater areas to prevent the tank from floating.

b. A screen must be placed around the pump with 1/8" holes or slits of non-corrosive material and have a minimum of 12 square feet of area. Its placement must not interfere with the floats and it should be easily removable for cleaning. Effluent filter designs fitted with a closing mechanism are a suitable alternative to screens around pumps.

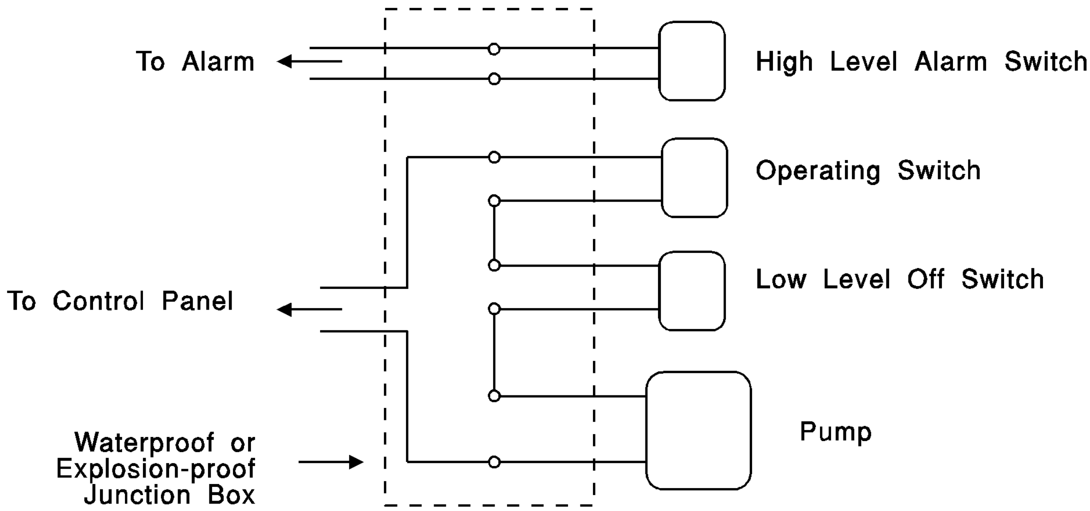
c. Electrical Requirements (Contact the Division of Building Safety, Electrical Bureau):

1) Visual or audio alarms on a separate circuit from the pump must be provided to indicate when the level of effluent in the pump or siphon chamber is higher than the height of the volume of one dose.

2) All electrical connections must be made outside of the chamber in either an approved weatherproof box or an explosion-proof junction box (Crouse-Hind Type EAB or equivalent). The lines from the junction box to the control box must pass through a sealing fitting (seal-off) to prevent corrosive gases from entering the control panel. All wires must be contained in solid conduit from the dosing chamber to the control box.

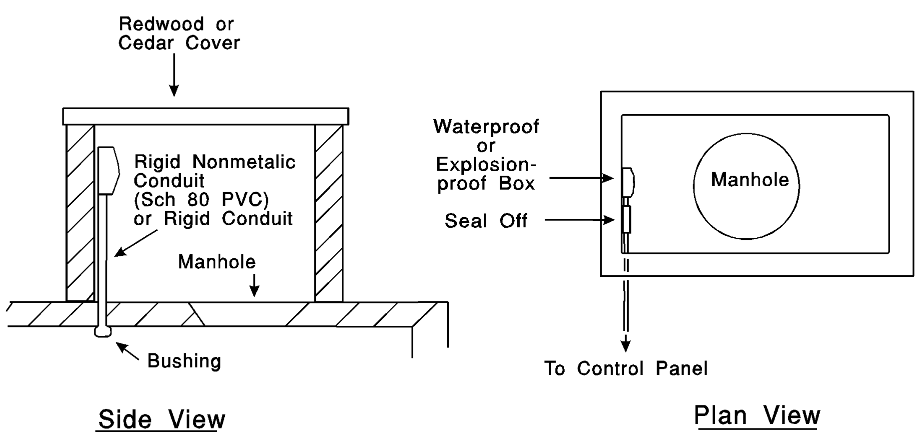
3) The minimum effluent level must be above the pump. This is the level that the low level off switch is set and should be 2-3" above the pump.

4) An acceptable circuit is shown in the following diagram:



5) Plans and schematics for the electrical installation should be approved by the Division of Building Safety, Electrical Bureau prior to installation and at the same time the permit is issued.

6) An alternative to placing the electrical connections on a pole is to place them in a dry well over the dosing chamber. The following diagram shows an arrangement acceptable to the Electrical Bureau:



d. The volume of the dosing chamber should be equal to at least two day's flow. A 750-gallon tank will provide sufficient volume to keep the pump covered with effluent, provide an 80 to 120-gallon dose and store one day's flow for most single dwelling installations.

8. In-Tank Pumps. Placement of sewage effluent pumps in a septic tank is an acceptable practice under the following conditions:

   a. Sewage effluent pumps must be placed in an approved pump vault.

   b. The drawdown of effluent from the septic tank is limited to a maximum 120 gallons per dose with a maximum pump rate of 30 GPM.

   c. Septic tanks must be sized to allow for one days flow above the high water alarm, unless a duplex pump is used.

   d. The pump vault inlets must be set at fifty (50%) percent of the liquid volume.

   e. Placement of the pump vault inside the septic tank shall be in accordance with the manufacturer recommendations.

   f. Pump vault screens shall be one-eighth inch (1/8") holes, or slits (or smaller); be constructed of non-corrosive material; and have a minimum of 12 square feet of area.

   g. Placement of the pump vault and pump must not interfere with the floats or alarm and pump vault should be easily removable for cleaning.